MACHINE AND TOOL ENGINEERING

The TOOL ENGINEER

APRIL, 1943

Official Publication of American Society of Tool Engineers

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erformance—Economy . . One source of supply

Collets and Feed Fingers for all makes of
Automatics, Chucking Machines and Turret Lathes

HARDINGE
ELMIRA, N.Y.

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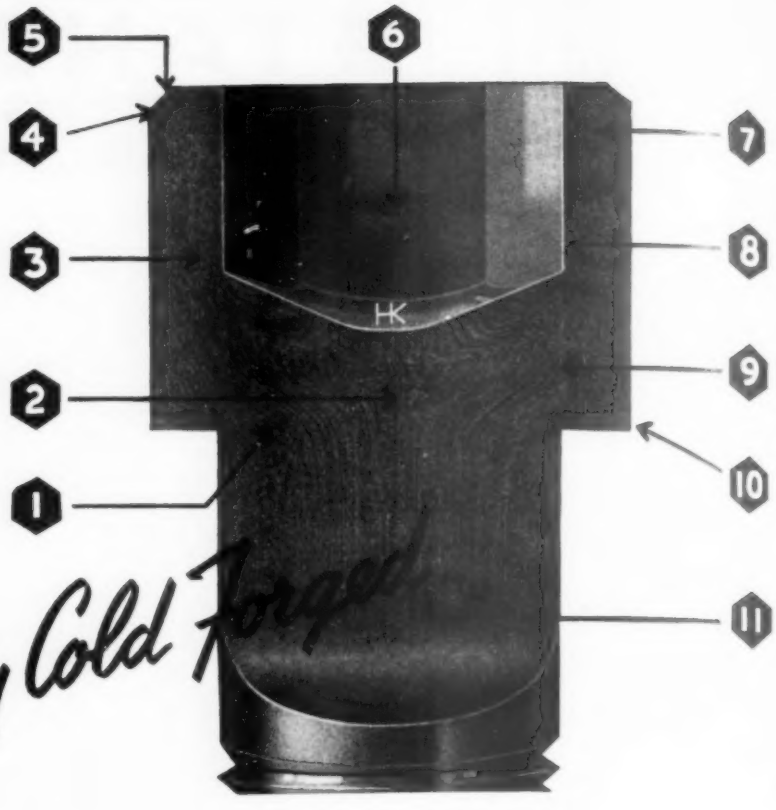
ETCHED CUTAWAY
HOLO - KROME SOCKET HEAD CAP SCREW



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1—INCREASED STRENGTH.

2—CONTINUOUS UNCUT LATERALLY DEFLECTED CORE FIBRES.

3—CONTINUOUS UNBROKEN FIBRES.

4—SMOOTH FLAT TOP WITH SLIGHT CHAMFER.

5—CONCENTRICITY OF HEAD WITH BODY.

6—SOCKETS — UNIFORMLY ACCURATE TO FULL DEPTH OF HOLE — TRUE HEXAGONAL SHAPE — ACROSS FLAT SECTION DIAMETER IDENTICAL TOP AND BOTTOM — NO TAPER — SMOOTH REGULAR WALLS — WELL DEFINED CORNERS.

7—CONTINUOUS FIBRES ENDING IN SOCKET WALLS.

8—RE-INFORCED SOCKET WALLS.

9—CONTINUOUS UNCUT FIBRES.

10—SQUARE SHOULDERS.

11—ORIGINAL CONTINUOUS FIBROUS STRUCTURE.

THE RESULTS OF A SUPERIOR METHOD PATENTED BY HOLO-KROME AND EXCLUSIVELY USED IN THE MANUFACTURE OF

HOLO-KROME
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SOCKET SCREWS

GUARANTEED Unfailing PERFORMANCE

THE HOLO-KROME SCREW CORP. HARTFORD, CONN., U. S. A.

The
TOOL ENGINEER

VOL. XII T.M. REG. U.S. PAT. OFF. No. 4

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WHAT'S NEW?

EACH month, the editors have tried to include an article on the elementary phases of a machining or tooling process.

Before telling you more about why the editors decided on this program last spring, you may be interested in knowing that this month's story is on honing. Our reason for pointing it out is that material often seems elementary only to the engineer with the complete know-how on the process.

Many men in war production have been suddenly shifted to different work. We sensed a need, because of this, for "elementary" information on certain methods. Thus, last spring we planned a 20-page feature on broaching. To Detroit auto men, this material might not, at first blush, have seemed to have tremendous value, but some of them soon discovered a finer precision tool in their shops than they had realized. In many plants around the country, however, production demands such as warrant the use of broaching had never been called for, until war came. These plants welcomed this feature.

Next, the editors decided to try an even more widely used process—grinding. Here the thought was that the production executives who read this publication would turn the material over to young fellows coming up, thus saving themselves some of the laborious training job ahead of them. That purpose was served, but there was a surprise, and this time, tables were turned on Detroit. From one of the country's largest auto body plants came a request for 150 reprints for production executives. These men who had spent a working lifetime at body construction had never been called upon to employ more than elementary surface grinding. But, building weapons demanded all kinds of grinding, and this 16-page feature told them what could be achieved.

●

Perhaps strangest of all, however, was the "discovery" of hard chrome plating, a process which has been used for the past 15 years or more. Last August, we carried the story on comparative tool and gage life with and without hard chrome plating. One reader was so excited about the possibilities that he filled his car with department heads and stripped his coupon book to see the process.

●

Newness is just a matter of when you happen to hear about something. The Crowell-Collier Publishing Company, which "discovered" the value of hard chrome plating, offered their process to industry, royalty-free. To them must go credit for unselfishness, yet one plater has been prolonging cutting tool life with hard chrome for nearly a decade.

An editor has just returned from an aircraft gear plant. He was first to get a story since the plant was finished more than a year ago. Censorship is so tight we can only say now that this plant is a complete catalogue of the newest types of gear manufacturing equipment. We hope plant and Air Corps authorities will approve publication for an early issue.

FOR FASTER BROACH DELIVERY

This Information

IS NEEDED HERE

When you order or request a quotation on a broach these are the things that we must know:

MACHINE—Type, make and model. If these are not known state maximum stroke and tonnage.

MATERIAL—Kind and hardness. Specific and complete information will raise no questions and will result in tools of longer life and better performance.

SHAPE OF CUT—Exact and complete dimensions including tolerances to be maintained. SEND A PART PRINT IF POSSIBLE.

LENGTH OF CUT—Exact distance each tooth must travel in contact with the work. This is very important and can best be told by a PART PRINT.

OTHER OPERATIONS—What operations precede the broaching? For instance, is the hole drilled or reamed and to what size? If there is any doubt about the best method of processing, we will be glad to make recommendations.

REMEMBER, THERE IS NO SUCH THING AS TOO MUCH INFORMATION

The engineering department of the Detroit Broach Company. Let these broaching experts carry the responsibility for your broaching production from the part print to the finished piece.

DETROIT BROACH COMPANY

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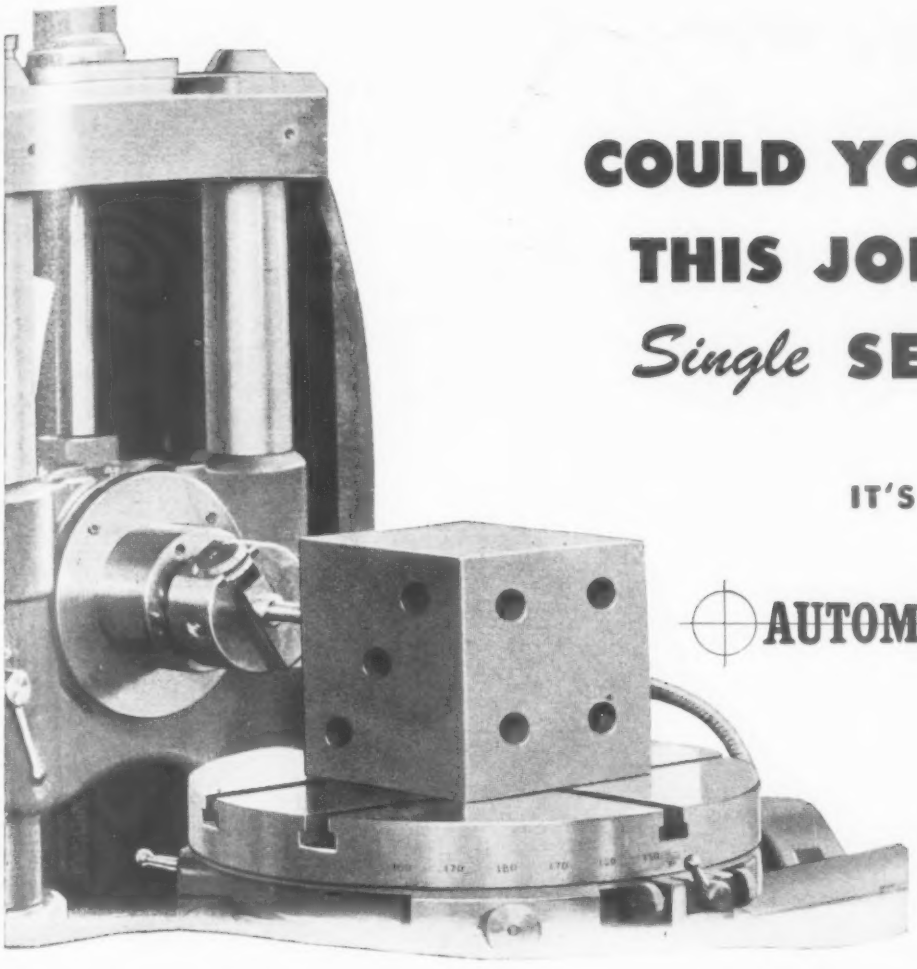

COULD YOU BORE THIS JOB IN A *Single* SET-UP?

IT'S A *"Natural"* WITH THE AUTOMETRIC MODEL B

The illustration shows a typical time-saving operation on the Autometric Model B. All of the holes in all four sides or at various angles in a box jig or production part are produced with one clamping of the work piece.

Its ability to handle a complete job in a single set-up—more rapidly and accurately than ever before—makes the Autometric Model B indispensable equipment for the precision boring of a wide variety of parts.

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Write for complete information on the Model B Autometric Jig-Boring Machine.

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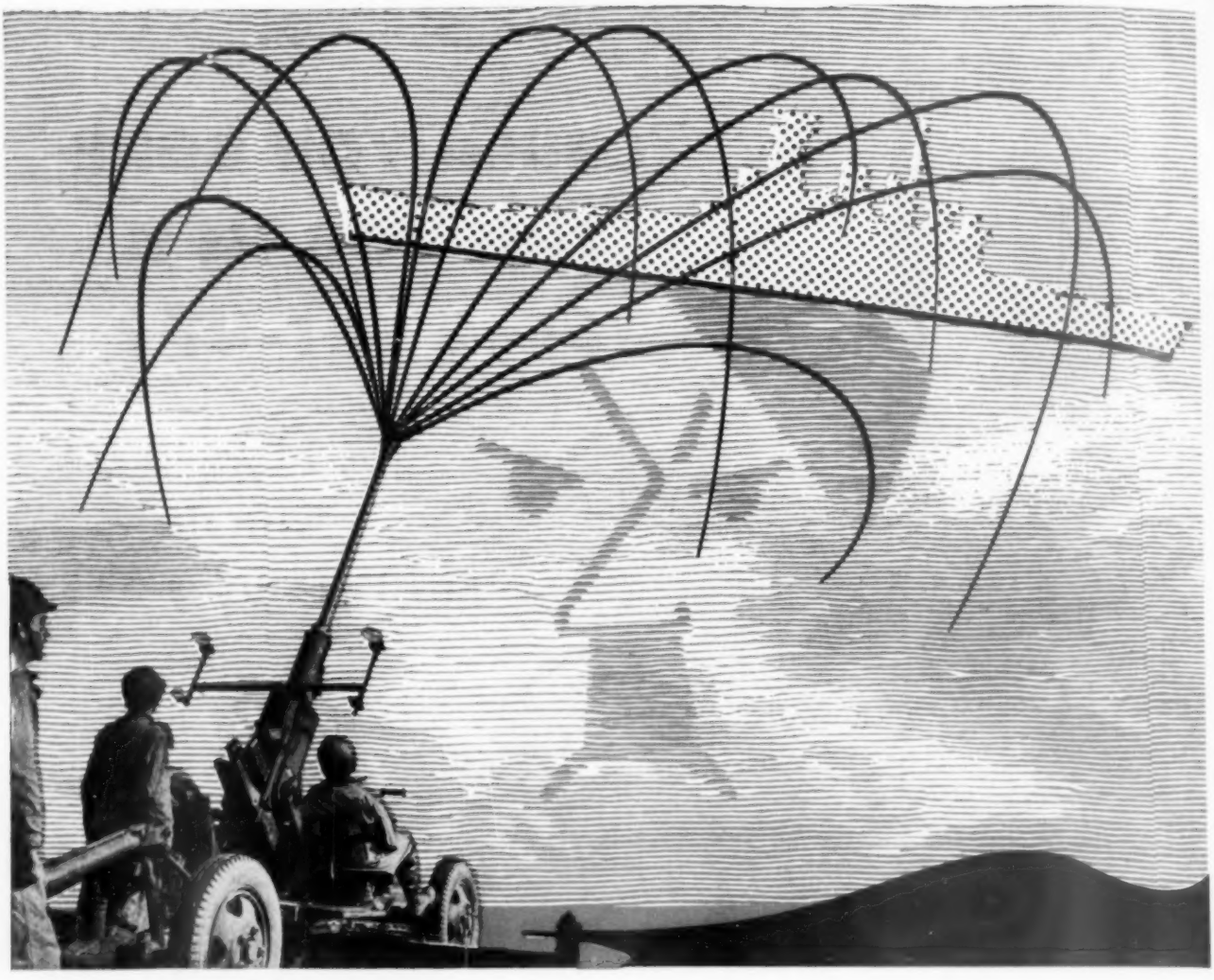


Launching a battleship . . . in the air!

HITLER'S HEART would indeed "bleed with wrath" if he could hear this story . . . a story of the spectacular performance of one of the guns being produced by American industry.

You've probably heard of our Bofors 40-mm. guns. But did you know that batteries of these guns can put into the air—in a matter of minutes—enough shells to equal the weight of a battleship?

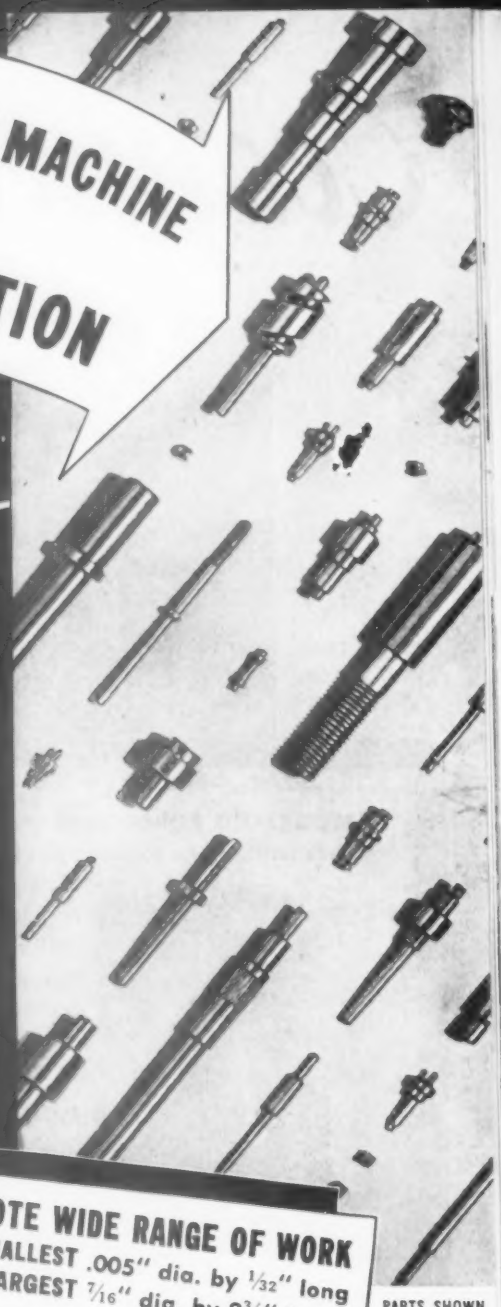
The enormous quantities of these guns and shells now being produced are a military secret, but we can tell you this: The volume is 'way in excess of our wildest dreams, in peacetime, back before Pearl Harbor.

An important contributing factor to this production is the amazing output of Cone Multiple Spindle Automatic Lathes. With a large 8-spindle Conomatic, it takes **only 28 seconds** to complete 17 of the operations required in the machining of a 40-mm. steel shell body!

Since 1939, the machine tool industry has "upped" production by 750%. Cone Automatic Machine Company is proud to be a part of this miracle-making industry. Proud, also, to know that in the new era of prosperity after the war, Cone Automatic Lathes will be just as essential as individual free enterprise.

CONE Automatic Machine Company, Inc., Windsor, Vermont

NEW *Precision* AUTOMATIC SCREW MACHINE
Solves Tough Jobs Like These...
Complete – IN ONE OPERATION



Product of Two Names Famous for *Precision*

The Original Swiss PETERMANN Model P-7

Re-engineered by GORTON Improved - Modernized

NOTE WIDE RANGE OF WORK
SMALLEST .005" dia. by 1/32" long
LARGEST 7/16" dia. by 2¾" long

PARTS SHOWN ACTUAL SIZE

GORTON ANNOUNCES a new, more versatile Precision Automatic—the Model 16-A Screw Machine. Built to meet America's emergency and post-war critical needs for mass production of extremely small, intricate parts. Long, slender pieces—multiple diameters are finely finished to closer tolerances, in one operation. Unique design offers almost limitless scope in generating any shapes. Present deliveries, 6 to 8 weeks.

Exceptional ACCURACY AND QUALITY OF FINISH

High diametrical accuracy—work rigidly supported at point of cutting tool load. Unusually high finish—grinding often eliminated.

LOW TOOL AND OPERATING COST...

Maximum accessibility for quick set-ups. Uses only standard single point tool bits. Micrometer adjustments on every tool. Centralized controls—infinitely variable speeds and cam feeds at touch of dials.

LONG LIFE OF PRECISION PERFORMANCE ...

Slow movements—short stroke—freedom from vibration.

R GOLDEN
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Exclusive manufacturing rights have been granted to Gorton by S. A. Joseph Petermann, Moutier, Switzerland, through their U. S. distributors, Russell, Holbrook & Henderson.

Gorton 16-A retains all the famous features of the Petermann P-7, with complete re-engineering by Gorton, adding further improvements and refinements.

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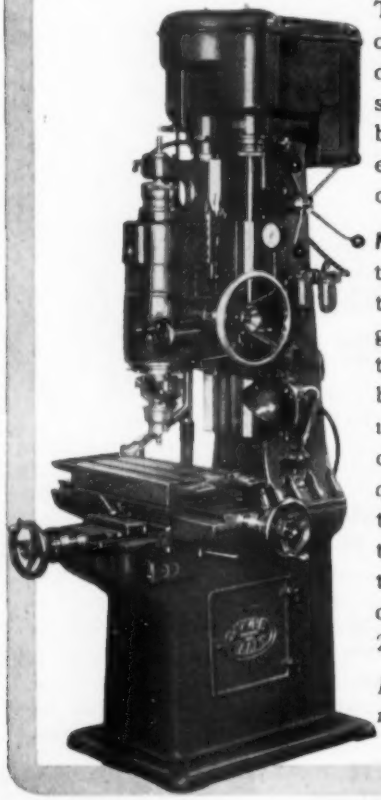
SPECIALISTS FOR 50 YEARS IN REPRODUCING FROM MASTERS—ENGRAVING DIE MAKING VERTICAL MILLING MACHINES

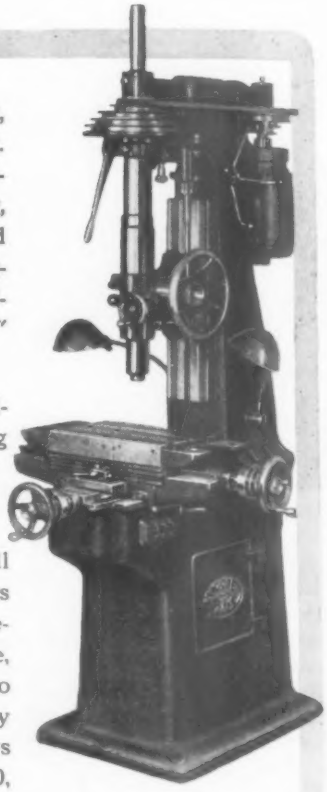
Teamwork SCORES IN THE TOOLROOM, TOO

Official Photo
U. S. Army
Signal Corps

The mechanical time fuse which fits in the nose of anti-aircraft shells is a complicated piece of clockwork requiring multiple-station dies of extreme precision. These dies were designed and produced by Moore tool-and-die specialists, aided by the speed and efficiency of the Moore Jig Borer and the Moore Jig Grinder, "Partners in Production."

MOORE JIG BORER bores the holes in these die sections before hardening, thus holding the location as close as possible to eliminate excessive grinding. This Partner features a fundamental process of co-ordinate location, which permits accurate spotting, drilling, reaming and boring in one uninterrupted sequence. Easy to operate, it solves layout and jig-boring problems, produces more holes to closer tolerances in less time. It is sensitive for holes of 1/32" or smaller, and rigid for heavy cuts.





MOORE JIG GRINDER finishes the pieces of the multiple-station dies after hardening. Instead of grinding the holes in each section of the die at a time and going through all of the laborious steps of centralizing, locating, indicating, grinding, re-assembling and checking, the Moore Jig Grinder does it all in one setting, with the die completely assembled in its own die-set and located on its own dowels—*in one-quarter the time!* Besides this saving in toolroom time, the Jig Grinder increases the life of a die from two to twenty times that of an unground die. It has a capacity to grind holes from .030" to 4", accuracy of screws of .00005" per inch, and grinding speeds of 15,000, 25,000 and 45,000 RPM.

Discover how these two machines and their time-saving accessories can modernize your toolroom operations. Write today for descriptive catalogs.

Manufactured by MOORE SPECIAL TOOL CO., INC · Bridgeport, Conn.

MOORE TOOLS

EXCLUSIVE DISTRIBUTORS: MARBURG BROTHERS, INC · 90 WEST STREET, NEW YORK, N.Y.

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TO BREAK UP YOUR ALLOY-STEEL CHIPS AUTOMATICALLY FOR SAFETY AND PROFIT

CHIP CONTROL. The rapid machining of **alloy steel** requires effective means of controlling chips. Long, hot, tough chips endanger the operator, make chip disposal difficult, reduce the value of scrap (by $2.00 a ton), cause tool breakage, and delay work.

The remedy is properly designed chip breakers. Tools with chip breakers require a little more power but, where long chips are a problem, chip breakers are the answer.

Aside from the safety factor, chips that can be **shovelled** are readily marketable as scrap, command a higher sale price per ton, and—most important to the war effort—speed the **recovery** of scarce and critical alloys.

NO CONTROL without Chip Breaker OR CHIP CONTROL with Chip Breaker

HOW TO GRIND A CHIP BREAKER EASILY, QUICKLY, INEXPENSIVELY
Typical Chip-Groove Design
A quick, simple method of designing and grinding chip breakers, as illustrated, is described on pages 41 to 43 of the FIRTHITE Users' Handbook....or a FIRTHITE Engineer will gladly discuss chip control in your plant.
USERS' HANDBOOK
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CUTTING TOOLS
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Firth-Sterling

STEEL COMPANY

MAKERS OF FIRTHITE TUNGSTEN-TITANIUM CARBIDES FOR STEEL CUTTING

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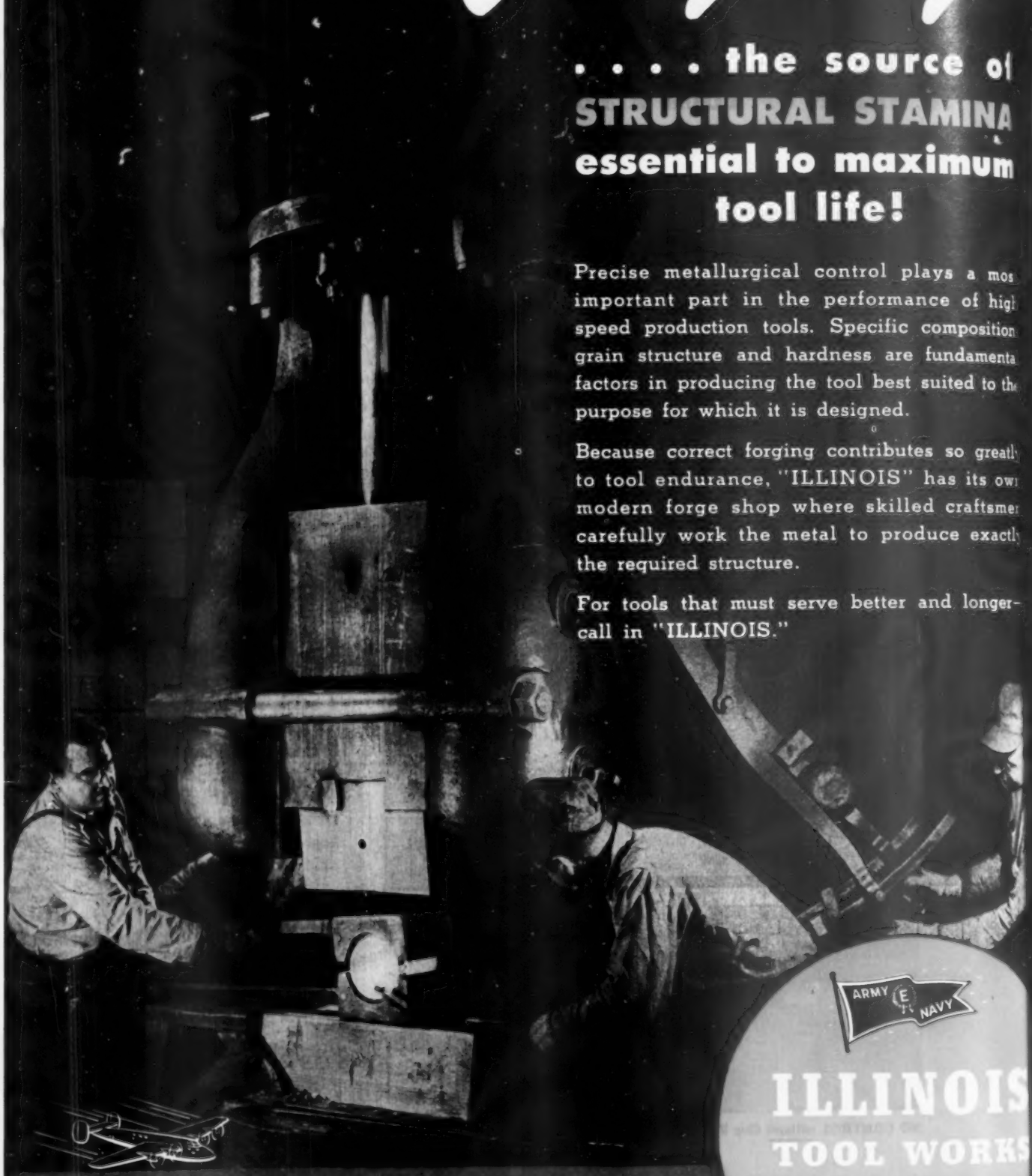
ILLINOIS *Forging*

. . . . the source of STRUCTURAL STAMINA essential to maximum tool life!



Precise metallurgical control plays a most important part in the performance of high speed production tools. Specific composition, grain structure and hardness are fundamental factors in producing the tool best suited to the purpose for which it is designed.

Because correct forging contributes so greatly to tool endurance, "ILLINOIS" has its own modern forge shop where skilled craftsmen carefully work the metal to produce exactly the required structure.

For tools that must serve better and longer—call in "ILLINOIS."

ARMY (E) NAVY

ILLINOIS TOOL WORKS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

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MANPOWER INCREASED

3 TIMES

OPERATOR HANDLES

11 Operations...

ON 3 PLATEN TYPE FASTERMATICS

These steel sleeves for airplane engine crankcase bearings require eleven operations including boring, turning, facing and chamfering. The operations are divided over three (3) Foster Platen Type Fastermatics—automatic production lathes. One man handles all three machines, completes a part every 7 minutes.

ENTIRE MACHINING CYCLE AUTOMATIC

The Platen Type Fastermatic is generally constructed with 3 tool carrying units: a front and rear cross slide and a main slide, all of which are mounted on a platen. The platen is hydraulically actuated, moves tooling to working position, and after all operations are completed, recedes to starting position and stops.

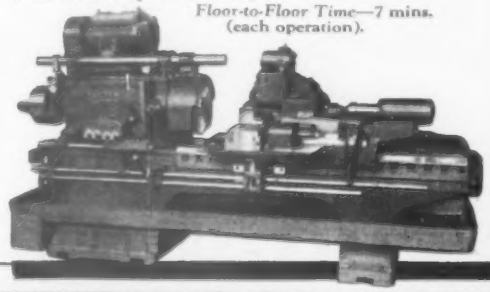
The Platen Type Fastermatic is extremely simple to operate. The entire machining cycle is automatic and as in this case, one operator can usually handle several machines.

The Platen Type Fastermatic is an ideal machine for high production work requiring moderate tooling. For similar work requiring more extensive tooling, investigate the Foster Fastermatic Turret Lathes.

FREE: Write for the new "Fastermatic" Catalog. Learn about the outstanding time-saving features of these highly productive, automatic "Fastermatic" Turret Lathes. Write to Foster Division, 1104 Beardsley Avenue, Elkhart, Indiana.

FASTERMATIC DATA

Part—Sleeve for airplane engine crankcase bearing.
Material—Steel.
Tool Set-up—For three machines as follows:
1st Machine—Rough and semi-finish O. D. 7.790".
Rough and semi-finish face 1.600".
Rough bore inside diameter.
Rough chamfer 45°.
2nd Machine—Rough finish bore large and small I. D.
Rough and finish other face.
Finish face inside lip.
Turn .080" radii in corner.
Chamfer I. D.
3rd Machine—Finish O. D.
Finish Face.
Finish 45° Chamfer.
Holding Method—
1st Operation—Chuck on inside diam.
2nd Operation—Chuck on ring on outside diam.
3rd Operation—Chuck on ring on inside diam.
Feeds—1st and 2nd Operations..... .008"
3rd Operation..... .012"
Speeds—1st Operation.....193 r.p.m.
2nd and 3rd Operations.....277 r.p.m.
Finish Accuracy—within .004".
Floor-to-Floor Time—7 mins. (each operation).



INTERNATIONAL MACHINE TOOL CORPORATION

FOSTER DIVISION, ELKHART, INDIANA · LIBBY DIVISION, INDIANAPOLIS, INDIANA

MAIN OFFICE AT ELKHART, INDIANA

FOSTER FASTERMATICS · LIBBY HEAVY DUTY TURRET LATHES · STANDARD TOOLS

Photo Courtesy Bell Aircraft Corporation

THIS airplane worker is finishing up a die for a fuselage part for Bell Airacobra P-39 pursuit planes. It's just another instance of how Bell Aircraft is speeding production with the help of improved finishing operations.

Finishing the die is a painstaking job calling for specialized skill. The rough casting must be scraped and then sanded and finished with coated abrasives to give the required fidelity to the specified contours and to produce the smooth surfaces necessary for perfect stamping operations.

This process is speeded by using Aloxite Brand Aluminum Oxide Coated Abrasives in various forms specially adapted to the different contours encountered. Abrasive discs, No Lap bands and cloth sheets are used as the particular operation requires. Net result to Bell: speed-up of the die preparation process and saving of precious man-hours for tooling operations.

The Carborundum Company has been a leader in developing a number of new forms of coated abrasives to meet the requirements necessitated by war production. A number of these items are described in our pamphlet "Weapons for Production." Send for your copy.

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ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.
REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

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UNCLE ISH is the derndest feller. He paid 4½ cents for that weapon, and he can shoot a clay pipe right out of your mouth at 100 yards. What's more, he's a one-man army. . . . Incredible? Well, here are the facts:

The famous Robbins & Lawrence and E. G. Lamson companies, ancestors of Jones & Lamson, had working for them in the 1800's two of the finest gunsmiths in the world. They were Albert Ball and Benjamin Tyler Henry, and the genius of these two men contributed much to the invention of a gun that was destined to make history.

That gun is known throughout the world today as the famous Winchester rifle — but in an earlier form, as the Ball lever-action repeater, it was known only as a headache to E. G. Lamson & Co. For there was a large order from the government for this revolutionary firearm, to replace the muzzle-loaders being used in the Civil War, but the war ended before delivery could be made.

The result: Hundreds of these repeating rifles were put up for sale at one-half cent a pound—and Uncle Ishmael got one. Nine pounds of the greatest gun in the world, for 4½ cents!

Later, when the patent for Ball's lever-action magazine was purchased and combined with improvements in rifle design made by Henry and another gunsmith named King, the great Winchester rifle was born. And it was an early advertisement for this rifle that told how Uncle Ishmael was a one-man army. "A man armed with one of these rifles," it read, "can load and discharge one shot every second, so that he is equal to a company every minute, a regiment every ten minutes, a brigade every half-hour, and a division every hour!"

The company in which that famous firearm had its origin is known today as Jones & Lamson, and the gun is typical of many great American products that have stemmed from the tools — and the men — developed by this company.

Jones & Lamson engineers and service men are at your call today . . . right now . . . to help you in solving the difficult problems of present and post-war readjustment.

JONES & LAMSON

Machine Company

SPRINGFIELD, VERMONT, U. S. A.

Profit-producing Machine Tools

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers.

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UNIFORMITY

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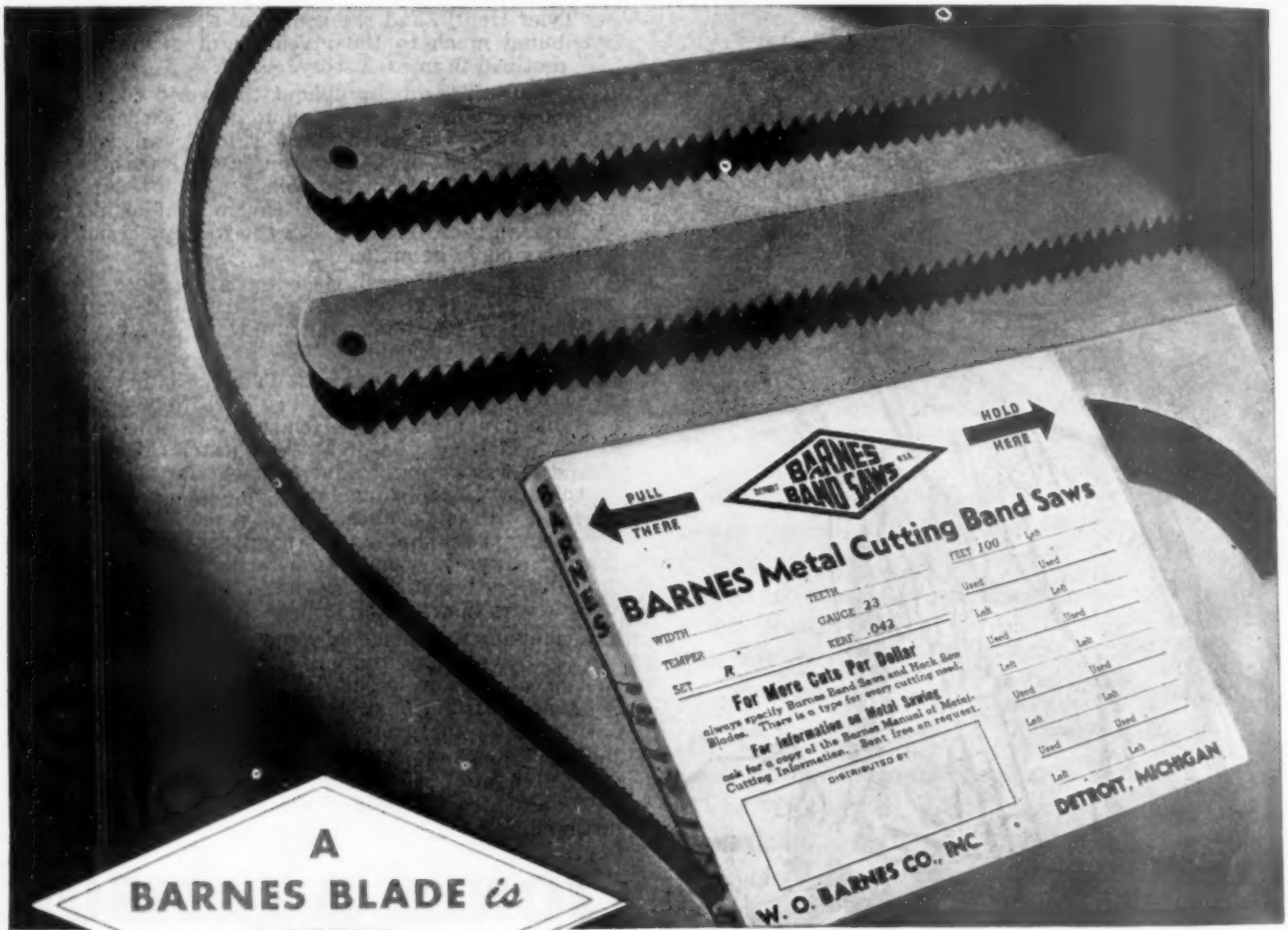
See our Exhibit at the A. S. T. E. show at Milwaukee, Booth 59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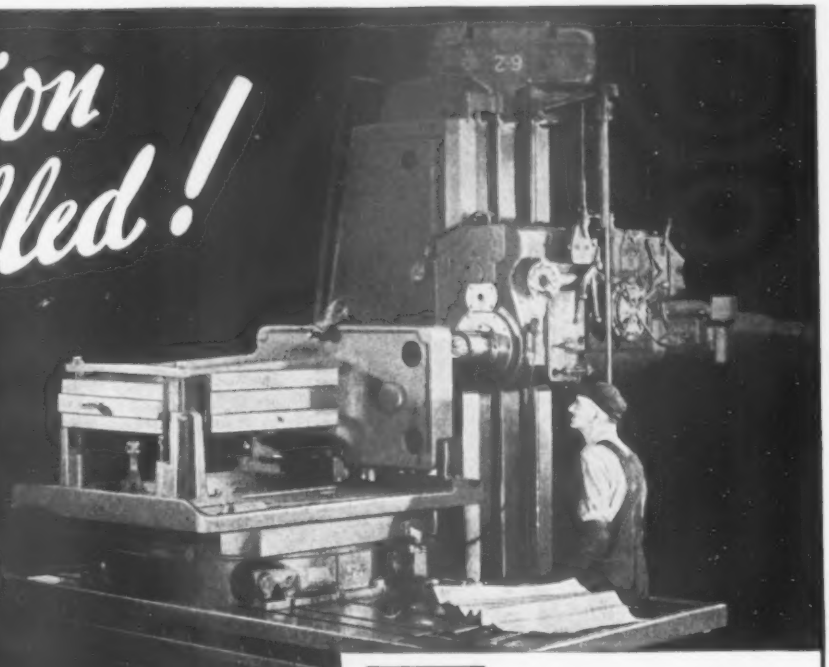
Production Doubled!

15-HOUR JOB REDUCED TO 7½ HOURS

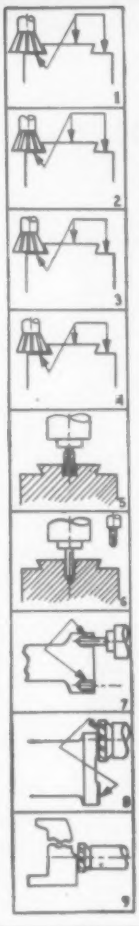


9 Operations Performed Include Rough and Finish Milling, Drilling and Tapping

It formerly took 15 hours to machine this machine-tool column. With this Giddings & Lewis Table Type Boring, Drilling and Milling Machine, the machining time has been reduced to 7½ hours.

In addition to increasing production and speeding delivery, accuracy has been improved. The columns were formerly machined on a traveling column machine with a fixed table. Both rough and finish milling cuts were completed on one side before resetting the column, thereby setting up strains and disturbing accuracy by not allowing the casting to cool.

This new G&L with the G&L rotary indexing table makes it possible to machine the entire casting in one setting. Operations can be performed in sequence best suited to obtain accuracy and production.



Versatility ... FOR PROPER MACHINING SEQUENCE

The proper sequence of operations performed on the column are shown below. Feeds and speeds used: Nine spindle speeds, from 23 to 183 r.p.m., nine table feeds from 1.9" to 16" per minute—one spindle feed, .019" per minute for drilling and tapping.

OPERATION 1—Rough dovetail way on top of column—7⅛" wide x 25" long. Index 90° for milling side.

OPERATION 2—Rough dovetail way on side of column—29" long. Index 90° for milling top.

OPERATION 3—Finish dovetail way on top of column—29" long. Index 90° for milling side.

OPERATION 4—Finish dovetail way on side of column—29" long. Index 90° for milling top.

OPERATION 5—Mill gear rack slot on top—15¼" long x .496" ± .001" deep.

OPERATION 6—Drill and tap eye bolt hole—$^{49}/_{64}$" drill, ⅞"—9NC Tap. Index 180° to drill bottom.

OPERATION 7—Drill 4 holes in bottom for hold down.

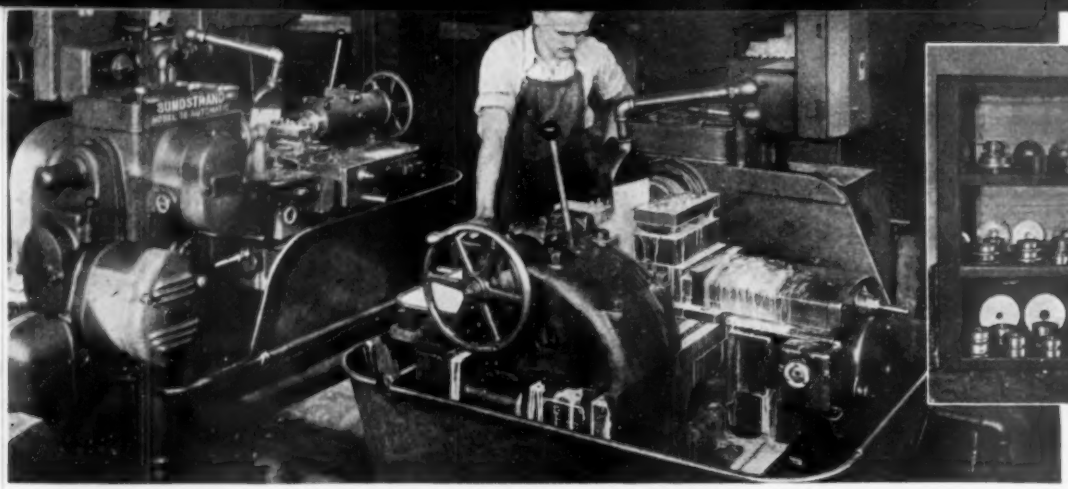
OPERATION 8—Mill pads on base. Index 90° for milling back side.

OPERATION 9—Mill surface for pump and coolant tank door.

GIDDINGS & LEWIS MACHINE TOOL CO.

132 DOTY ST., FOND DU LAC, WISCONSIN

Free Data — *Information covering the complete line of G & L machines and time-saving attachments and accessories is included in this catalog. Write for your copy. Ask for Catalog No. 45.*



(Above) One machine used for roughing, while the other finish turns. One man operates both machines on short run work.

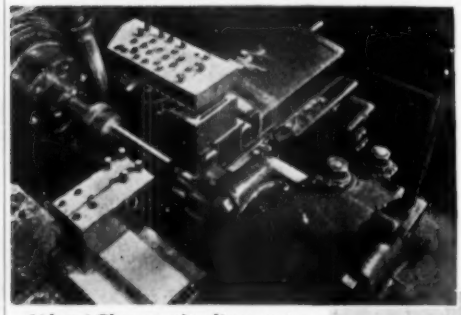
(Above) Some of the different parts turned on the Sundstrand Automatic Lathes. Lot sizes vary from 25 to 100 pieces.

Rough gear blank, rough turned part and finish turned part.

Production Increased 9 Times ON SHORT RUN TURNING

LOTS OF *25 to 100 Pieces* TURNED FASTER ON SUNDSTRAND AUTOMATIC LATHES WITH QUICK CYCLE CHANGE

This progressive machine manufacturer gets maximum production on short run turning. On one, of approximately 100 odd turning jobs, he has reduced the machining time from 45 to 5 minutes. Savings on other parts are proportionate.



(Above) Close-up of tooling set-up for Cluster Gear

(Right and Below) Quick set-up for short runs is accomplished by adjusting dogs on a graduated disk. Cycles are rapid approach, feed and quick return of 250" per minute. No cycle control cams required.

PARTS TURNED INCLUDE CAST IRON, STEEL AND BRONZE

Parts varying from simple gear blanks, cluster gears, sprockets, pulleys, sleeves, etc., in materials including cast iron, steel and bronze, are all turned on two Model 10 Sundstrand Automatic Lathes. Some of these parts are shown above. These are kept on shelf and used in setting up the machine for re-runs.

SET-UP TIME LESS THAN 45 MINUTES

Before installing the two Model 10 Lathes the manufacturer used another type of lathe equipment to rough and finish the cluster gear. The part is now rough turned on one automatic lathe and finish turned on the other. The turning for each operation is done simultaneously and completed in 5 minutes. The number of cluster gears turned in each lot is 30. One operator runs both machines, and set-up time for each is less than 45 minutes.

THESE EXCLUSIVE FEATURES ARE RESPONSIBLE FOR HIGHER PRODUCTION ON SHORT RUN WORK

Quicker set-up and easy change-over are possible because of the Sundstrand simple cycle control. It provides complete control of all cycles by adjustment of dogs on a disk...cams are eliminated. 6 dogs control all cycles. Rapid return is 250" per minute.

WIDE RANGE OF TOOL ACTION

A wide range of action for front carriage tools is provided by three units which can be used separately or in combination to give (1) Angular feed-in and tool relief. (2) Slow-up and dwell. (3) Straight feed-in and tool relief .... Many combinations are possible by making simple adjustments.

HOW TO TURN SHORT RUN WORK FASTER... is illustrated in this 16-page booklet describing the features of the Sundstrand Automatic Lathes. The quick set-up and easy change-over features are described. Write today. Ask for Bulletin No. 811.

LET SUNDSTRAND ENGINEERED PRODUCTION HELP YOU Our engineers are available to study and make recommendations on a productive machining sequence. They are at your service without obligation. Use this service freely, especially on urgent war jobs. Send complete, accurate information with each inquiry.

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Newly revised and reprinted—a comprehensive book on the properties, uses and best methods of handling, treatment, etc. of tool, stainless and other alloy steels. Plenty of tables to facilitate quick reference and selection. 124 pages, pocket-sized.

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ELEMENTARY DISCUSSION ON TOOL STEELS

An informative booklet that gives clear and detailed data on the various types of Tool Steels, their properties and handling. Excellent for training courses in metals and metal working.

IN more than one sense, and all of them very real, information is ammunition in these days of metal-working pressure.

Complete information on Tool Steels in the hands of production executives leads to the conservation of these highly strategic steels; to the selection of types better suited to individual jobs; and in many cases, to vast improvements in performance. (*A diesel engine builder, for example, found that DBL High Speed Steel reamers averaged 800 pieces per grind against a previous maximum of 200 pieces with 18-4-1.*)

The Allegheny Ludlum "Handbook of Special Steels" is a bible of data for production men, and our "Elementary Discussion on Tool Steels" is invaluable for use in apprentice and training courses. *Write for the copies you need.*

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STEEL CORPORATION
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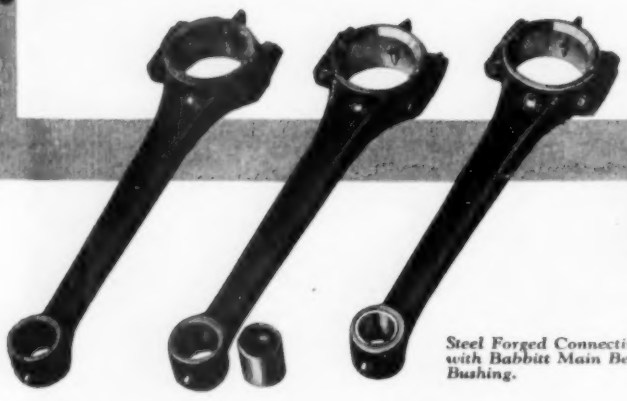
Accuracy of ±.0001" with *Extremely High Finish*

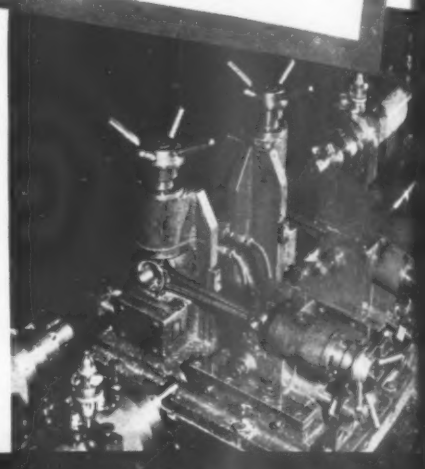
Maintained in Precision Boring Connecting Rod Bearings on a

STOKERUNIT SIMPLEX *Precision* BORING MACHINE



Steel Forged Connecting Rod for Gasoline Engine with Babbitt Main Bearing and Bronze Wrist Pin Bushing.

ACTUAL BORING TIME EACH 32 SECONDS COMPLETE



Special 3-Center Holding Fixtures for each end of the machine. The two ends alternate in the boring cycle, each end boring wrist pin and main bearing simultaneously.

Two operators maintain production of 70 connecting rods per hour. Actual boring time of each piece is 32 seconds complete.

In the plant of this gasoline engine manufacturer, both wrist pin and main bearings in connecting rods are bored simultaneously on a No. 2U Stokerunit Simplex Two-Way Four-Spindle Precision Boring Machine. The two double-spindle ends of the machine alternate in the roughing and finishing operations.

Here is the interesting operating cycle in this installation, as handled by two operators:

FIRST SPINDLE—Rough boring babbitt bearing; stock removal 1/32". Also facing and chamfering one side of bearing.

SECOND SPINDLE—Finish boring wrist pin end of rod in steel forging (230 Brinell); stock removal .010". Bore is .875" dia. by 1" long.

At this point, one operator removes the rod and presses in the bronze wrist pin bushing, while the other operator loads the machine for the initial operations.

THIRD SPINDLE—Finish boring babbitt bearing; stock removal .005". Bore is 1.752" dia. by 1 1/8" long. Also facing and chamfering other side of bearing.

FOURTH SPINDLE—Finish boring bronze bushing on wrist pin end of rod; stock removal .004". Bore is .750" dia. by 1" long.

One operator now removes this completed rod and loads other end of machine for the final operations.

PRECISION ACCURACY WITH SUPERIOR FINISH MAINTAINED IN PRODUCTION

Tolerances of ± .0001" *and better* are consistently held in production with diamond tools for the babbitt bearing and bronze bushing. An extremely high finish is produced. Tungsten carbide tools are used for boring the steel forging.

Actual boring time is a total of 32 seconds per connecting rod in all boring operations of wrist pin and main bearing bores. Spindle speed is 2600 r.p.m.; feed .002" per revolution. Total floor-to-floor time is 70 pieces per hour.

PROFIT WITH STOKERUNIT VERSATILITY

Stokerunit Simplex Unit-Type Precision Boring Machines are adaptable to innumerable precision boring operations. Over 25 models are available in both mechanical and hydraulic feeds, with single or multiple spindles, for either short-run or production work. Among them you will find the model which will solve *your* precision boring problems.

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It does not generate injurious frictional heat—hence avoids cracks.

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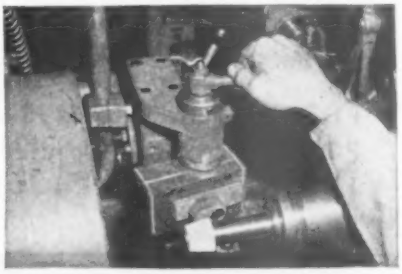
THIS MIGHT GET YOU OUT OF A JAM

In truing Radii and Angles

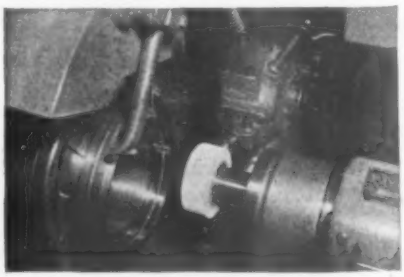
BUT FOR A GOOD JOB

YOU'LL WANT THE HEALD UNIVERSAL DIAMOND

The Heald Universal Diamond arranged with radius truing attachment. Trues wheel radii from 0 — 2½".



Heald Universal Diamond equipped with angular truing attachment. Trues wheel angles from 0 — 90°, has 1¼" stroke.



Heald Universal Diamond with straight truing attachment.

If the work ground on your Heald No. 72A Plain Internal is all straight-hole grinding the standard truing diamond is exactly what's required to do a good job of wheel truing. But if you have work that involves grinding of radii and tapers as well as straight surfaces, the standard diamond of course will take care of straight truing but not radii or tapers.

For truing wheels to special shapes two different methods can be employed. One method requires no more equipment than an abrasive stick, but should be considered only as a temporary expedient. Using this method the operator holds the stick in his hand and manually trues a radius or chamfer on the corner of the wheel, using a template for checking contour. Even with an experienced operator this is a cut and try procedure and consequently is inaccurate and slow.

The recommended process, if you want speed and accuracy in truing special shapes, is to replace the standard diamond unit with the Heald Universal Diamond. This truing device consists of a basic unit which can be furnished with three quickly interchangeable diamond attachments each specifically designed for the separate operations of radius truing, angular truing, and straight truing as illustrated.

Here's a really useful attachment which will give your Heald No. 72A Plain Internal extra flexibility for grinding a greater variety of work. Can be furnished as original machine equipment or supplied for attaching in the field.

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Gun Barrels . . . Consulted by a large ordnance plant on the possibility of obtaining greater production in the reaming of cartridge chambers in 1.1 gun barrels, a Gulf Lubrication Service Engineer recommended Gulf Electro Cutting Oil A. Result: production of reamed barrels increased 1500%—rejections reduced 50%.

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Torpedo Gears . . . By using the cutting oil recommended by a Gulf Lubrication Service Engineer, a manufacturer of torpedo parts increased output 41%, improved finish, and reduced rejects in cutting Monel metal gear blanks.

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Artillery Recoil Cylinders . . . By using Gulf L. S. Cutting Base A, a large ordnance plant increased production 30% and increased tool life 300% in machining operations on hardened nickel chrome steel forgings for artillery recoil cylinders.

Bomb Striker Nuts . . . Consulted by a manufacturer of steel striker nuts for bombs on the problem of 100% rejection of production due to torn threads in a tapping operation, a Gulf Lubrication Service Engineer recommended Gulf Lasupar Cutting Oil A and a suitable level on the end of the tap. Result: rejections entirely eliminated, production greatly increased.

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As a result of proven performance, over a thousand plants with difficult machining operations have adopted Gulf Cutting Oils during the past six months. Here's the record of improved machining practice in these plants: Production increased as much as 300%, tool life increased as much as 2000%, and marked improvements in finish. Write or 'phone your nearest Gulf office today for effective help on *your* machining problems.

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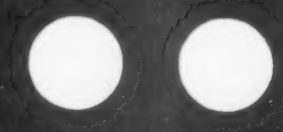

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STANDARD OIL ANNOUNCES

NEW Stanobar GREASE

For easier handling in grease guns

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A war-bred grease for wartime jobs. Today's production pace demanded this new type grease. Longer hours of operation alone call for a more stable grease to resist heat and oxidation, while the need for more frequent lubrication of bearings makes an easily handled gun grease an asset.

Stanobar brings you both these advantages. It's a smooth (not fibrous) type grease. It contains inhibitors which reduce oxidation of both the soaps and oil in Stanobar. That means less cleaning of bearings and less labor and lubricant required to flush out old grease.

Stanobar resists thinning out when worked—that helps reduce leakage. It may also enable you to replace two or three grades of grease you are now using with this one grade of Stanobar.

Let a Standard Lubrication Engineer explain some of the other advantages of new Stanobar—and help you make a test. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

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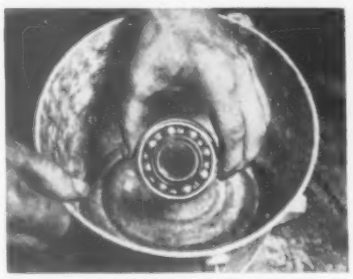
- . . . Easily handled in grease gun or pressure system.
- . . . Resists thinning-out when worked.
- . . . Does not oxidize and form deposits.

How to service ball and roller bearings. Proper packing of bearings after inspection is highly important. Bearings equipped with pressure fittings are sometimes replaced dry and filled with a grease gun, but a careful, hand-packed grease job is well worth the little extra time it may take. The illustrations at the right point out some of the steps to take.

OIL IS AMMUNITION . . . USE IT WISELY

Clean motor and bearing housing before removing bearing.

Remove bearing, wash it in kerosene, and dry thoroughly with a clean cloth.



Dip bearing in a light lubricating oil. Allow excess to drain before repacking.

Put grease only in depression of spacer (both sides). Then spin one of the races, and wipe off excess grease thrown out. Replace the bearing. Do not put additional grease in the bearing housing.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

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STELLITE 98M2 METAL-CUTTING TOOLS

For Machining Steel . . . Available for Immediate Deliveries . . .

Stellite 98M2 tools are made of a cobalt-chromium-tungsten alloy especially designed to increase the speed of machining steel. Developed by Haynes Stellite Company and Union Carbide and Carbon Research Laboratories, Inc., Units of Union Carbide and Carbon Corporation, this new alloy represents another achievement in the production of non-ferrous alloy cutting tools.

Tested on War Production—Stellite 98M2 tools have been thoroughly tested in the machining of many types of steel parts needed in the war program and are now being used for a wide variety of operations on such parts. Specific operations for which Stellite 98M2 alloy tools have proved especially suitable include turning, facing, boring, grooving, and forming of all types of steel.

High Rates of Metal Removal—These tools have proved that they will machine steel at even higher cutting speeds than Stellite Star J-Metal tools or Stellite "2400" tools, and with longer life between grinds. With the new tools, heavy roughing cuts can be taken with coarse feeds — to get high rates of metal removal —yet tool life is long and economical, for this new alloy has an *unusually favorable balance of red hardness, edge strength, and toughness.*

Available Forms—Stellite 98M2 tools are furnished as standard square and rectangular tool bits and welded-tip tools. Many sizes and types are available for immediate delivery. In addition, Haynes Stellite Company is prepared to furnish special tools made of this alloy, cast and ground to customers' specifications.

Send for this new descriptive price list. It will help you select the sizes and styles of Stellite 98M2 Metal Cutting Tools you require.

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Unit of Union Carbide and Carbon Corporation

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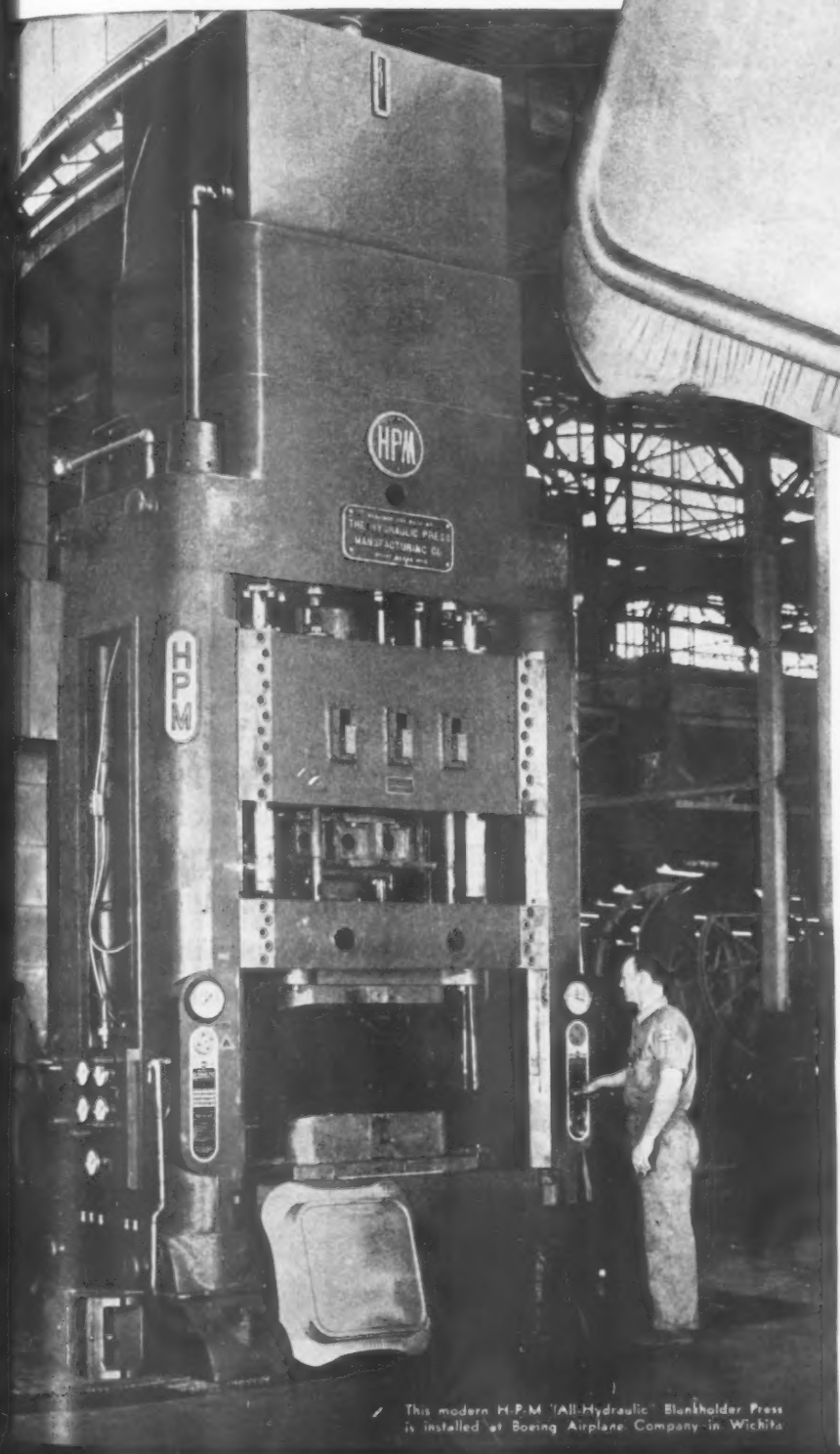
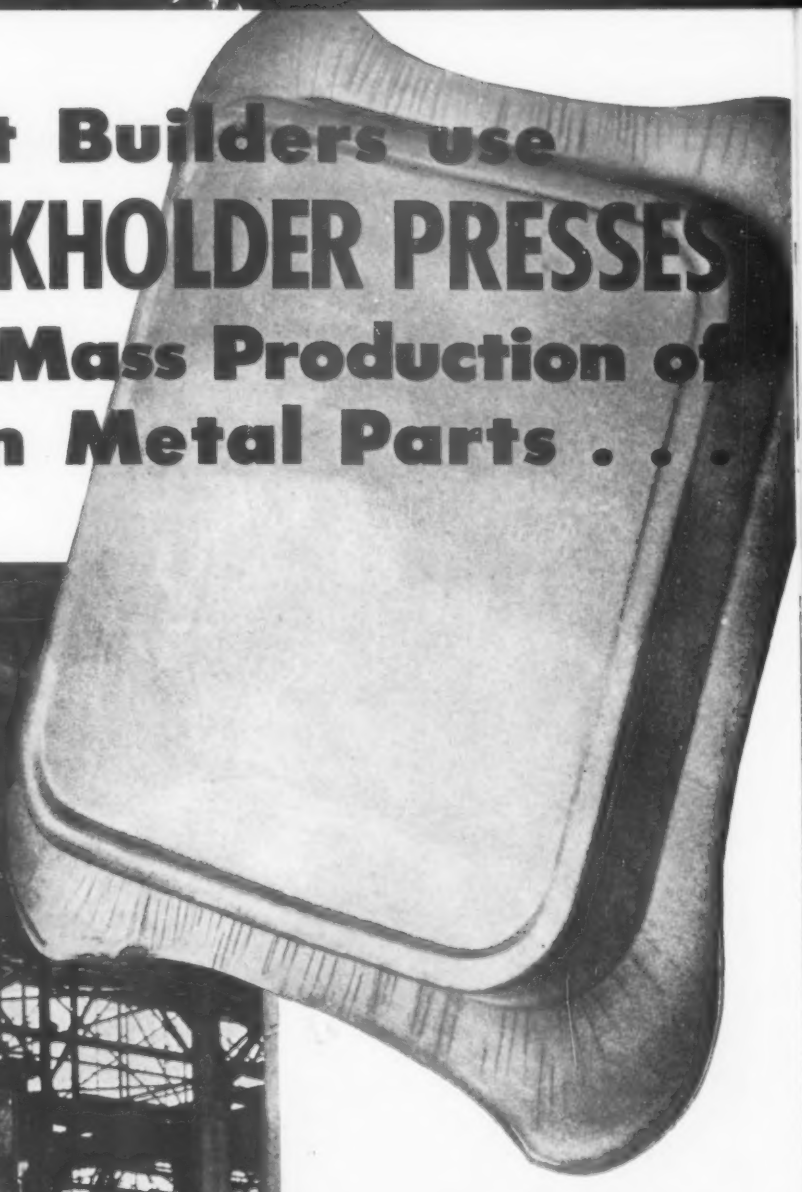


This modern H-P-M "All-Hydraulic" Blankholder Press is installed at Boeing Airplane Company in Wichita



H-P-M FASTRAVERSE Presses, equipped with both hydraulic blankholder and die cushion, are designed to accommodate all standard types of steel and "Kirksite" dies. Die set-up is quick and simple. A single pump generates hydraulic pressure for all press actions. All strokes and pressures are adjustable, including variable pressure at each of the four corners of the blankholder slide. The H-P-M "valveless" Closed Circuit operating system guarantees a fast, smooth press cycle with shockless reversal. Write today for Bulletin 4206 featuring H-P-M Metal Working Presses.

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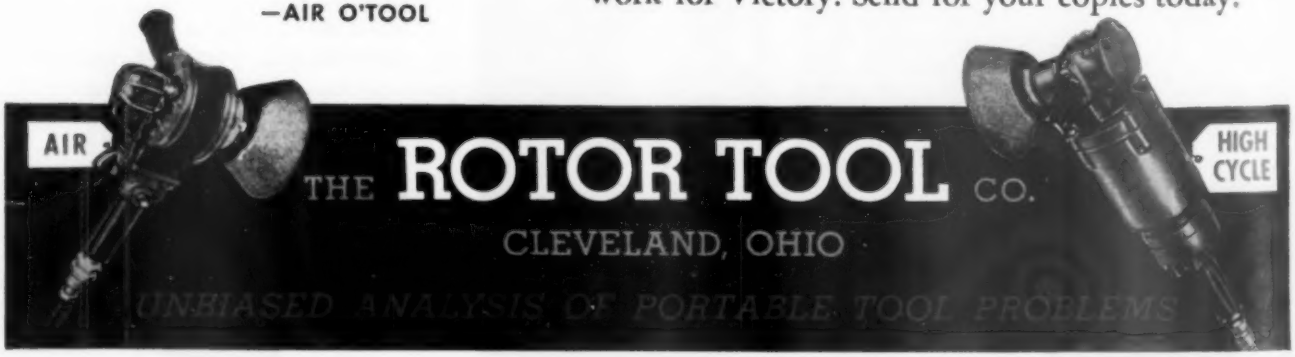
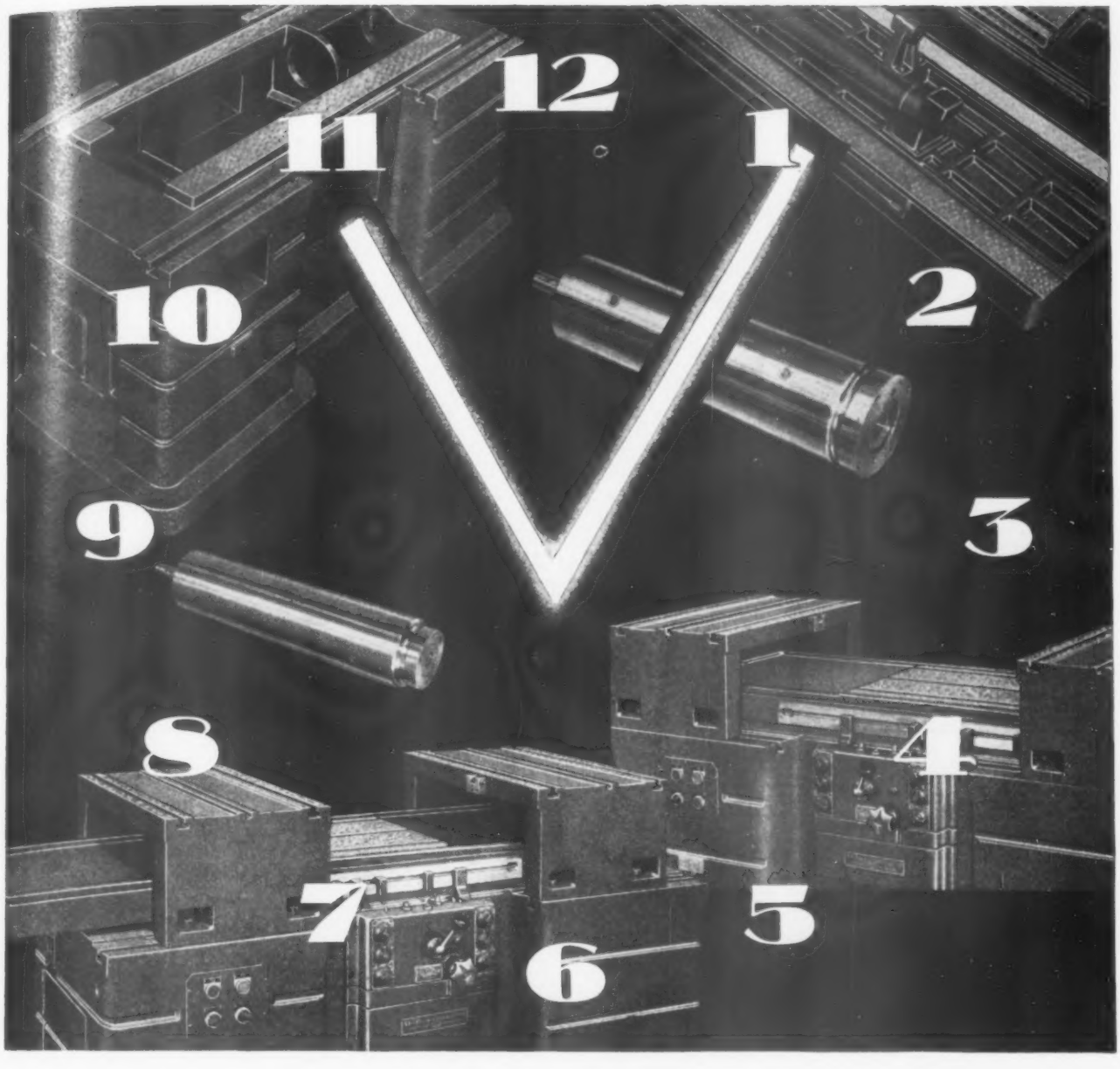
This Rotor Maintenance Manual explains in detail 11 ways to make *all makes* of portable AIR tools last longer and turn out more production . . . to cook the Axis goose. The high points also are given on a handy wall chart. They're free to plants that will put them to work for Victory. Send for your copies today.





BUILT FOR 24-HOUR SERVICE!

The Ex-Cell-O Precision Boring Machine is designed and built to "take it", every hour of the day, every day of the week. Moving parts, such as spindles, drive units, braking equipment, are located on bridges above the work table. These bridges, coupled with heavy base and reinforced table, provide a precision machine that is exceptionally solid and firm. Boring units are easily accessible so that adjustments and changes are a simple matter for the operator. The Ex-Cell-O name on a precision boring machine means not only a precision-built machine to do precision work, but a machine tool that gives the utmost in efficiency with a minimum in maintenance attention.

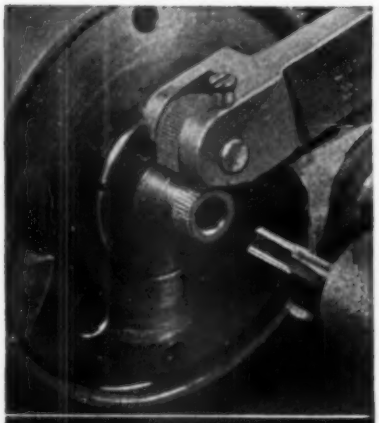
EX-CELL-O CORPORATION • DETROIT

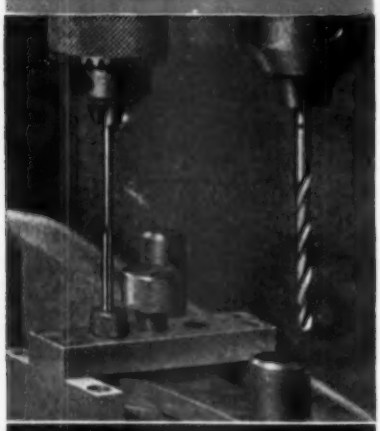
Below: No. 215-A—one of nine different styles of Ex-Cell-O Precision Boring Machines . . . for boring, turning, facing.

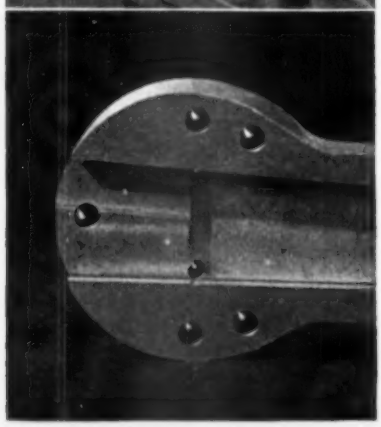
XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS







REAM BETTER HOLES

from .050" to .500"

with

BARBER-COLMAN *Ground-from-Solid* REAMERS

THESE solid fluted reamers will provide maximum accuracy in the range from .050" to .500". Cutting diameters are guaranteed within + .0002"/— .0000", but many will run even closer than that. In each case, the individual reamer is engineered for the job it is to do, thus assuring maximum cutting ability and longer life. B-C Ground-from-Solid Reamers are made from hardened blanks, centerless ground to specified cutting diameter, and then fluted from the solid. This method avoids all hardening distortion and provides these advantages: • There is no possibility of inferior, minutely dubbed cutting edges which may result when teeth are cylindrically ground after fluting. • The diameter is accurately established within tenths before the flutes are ground, making it unnecessary to measure across the flutes. • Smoother finish results on the cylindrical cutting land. There is no intermittent grinding as when reamers are fluted and then cylindrically ground to size. ★ *If you have fine precision work such as aircraft parts, guns, instruments, or small textile machinery parts requiring reamed holes, send us your prints for quotations and recommendations.* At present we have facilities available for delivery in approximately 8 weeks depending on priority rating available.

The photographs in the panel above show B-C Ground-from-Solid Reamers in operation and the finished parts. • The upper views show an aircraft part of nitralloy steel requiring a .2508"/.2510" hole with fine finish. • The lower views show a textile machinery part requiring holes .1880"/.1885" in cast iron.

Buy War Bonds

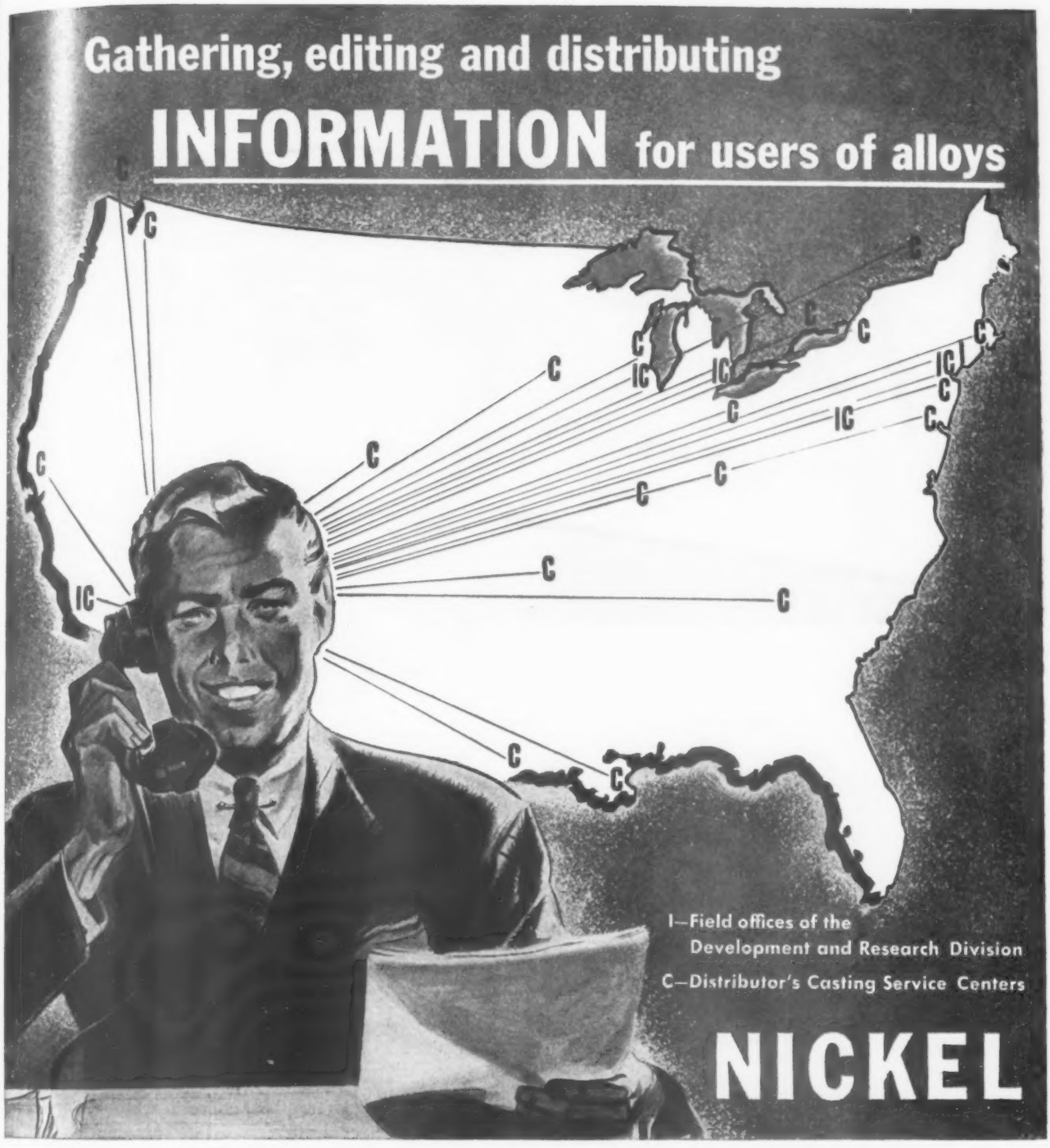
BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

GENERAL OFFICES AND PLANT • 213 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

Gathering, editing and distributing INFORMATION for users of alloys



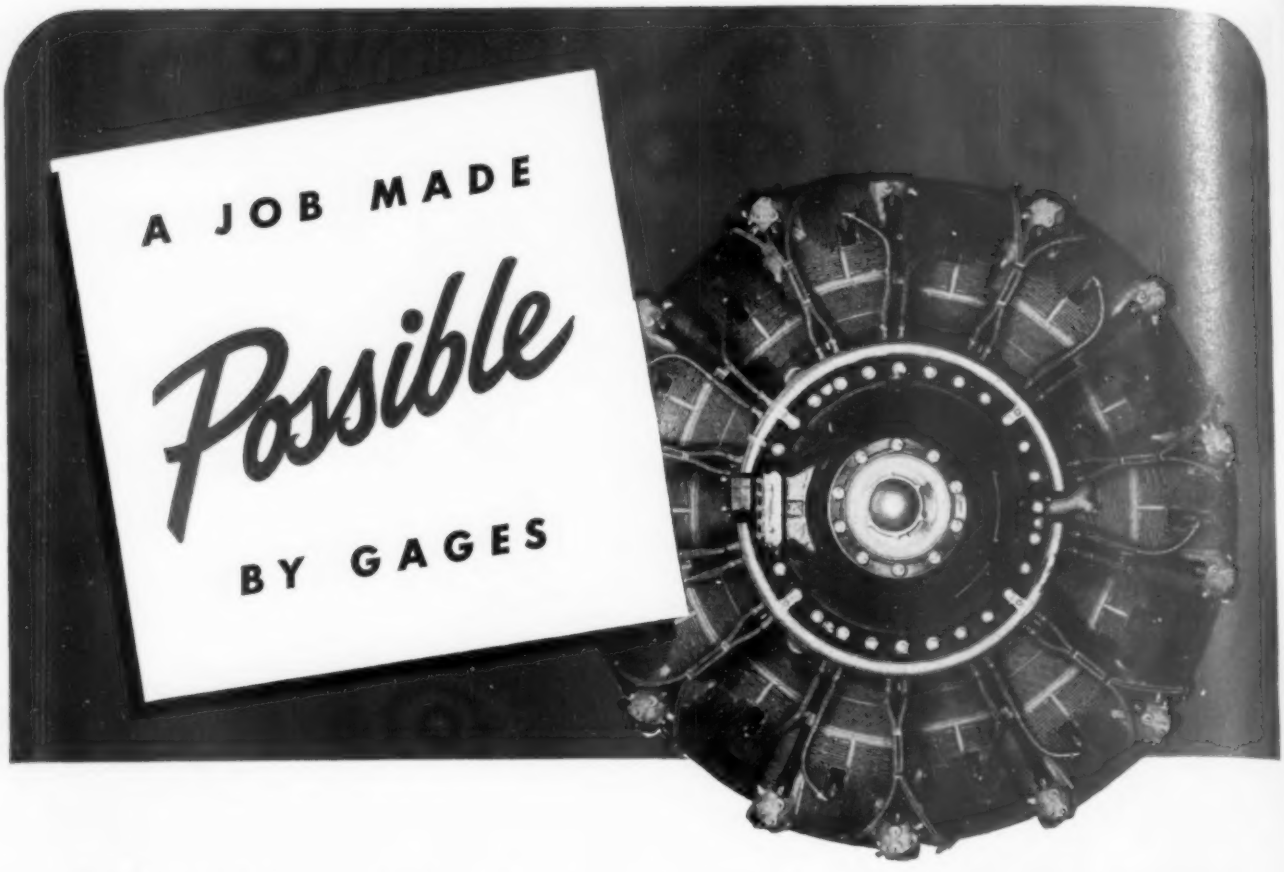
NICKEL

To aid users of Nickel alloys, thirty service centers are maintained in industrial areas. From these strategically located key points, our field representatives are on call to advise American industry about the selection, fabrication and uses of ferrous and non-ferrous materials. Assistance is also given on problems arising from the temporary lack of Nickel.

Through the years, research, field studies and user experience have all contributed to a fund of practical, time-proved information. Many of these data have been compiled in convenient printed form, useful both to experienced men handling new materials or performing unfamiliar operations . . . and to the many new employees.

Now . . . when minutes and materials are so vital . . . make full use of this metal-working experience. Send for a check list of helpful printed pieces on the selection, treatment, fabrication and use of Nickel alloys, or send your specific questions to:

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.



America needed more aircraft engines—many more!

The automobile industry, with its knowledge of precision manufacture and mass production methods, was selected to help build them.

In one engine plant, the first engine assembled, from regular production line parts, started at once and ran without any major adjustments.

This was not a handmade pilot model. It was the start of straight line production. Its parts all fit, because they were produced to fit, with each dimension controlled by accurate gages.

Without the gages, the job could not have been done!

PM Gages are doing their part in jobs like this, in thousands of plants. The PM Diamond emblem on a gage or tool is *your* assurance of initial accuracy. Extreme care in finish and hardening means longer life in service.

PM special gages—tailored to exact specification—usually require a favorable priority. PM standard gages in wide variety are carried in stock, for immediate shipment.

The new PM Catalog—your copy on request—will be of help to you in maintaining production controls.

ARMY E NAVY

PM CO

The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • HOBS • MILLING CUTTERS • SPECIAL TOOLS

QUANTITY-QUALITY PARTS PRODUCTION
a job successfully handled by

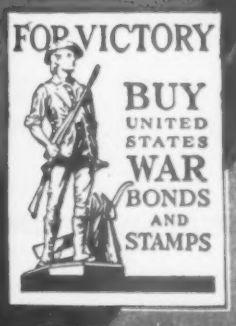
PHOTO BY U. S. ARMY SIGNAL CORPS

P&J *Automatic* CHUCKING EQUIPMENT

Wide flexibility in setup making it possible to perform all roughing and finishing operations in a single cycle is one of the reasons why P&J equipment is able to break production bottlenecks.

This ability to deliver the goods in fast floor-to-floor time is being taken advantage of in the many war production plants where P&J equipment is busy turning out essential parts for weapons of all kinds. Aircraft engines, tanks, guns and adaptors for shells are a few of the essential kinds of equipment that are getting "over there" in greater quantity and in shorter time because of the important contribution to parts production being made on P&J equipment.

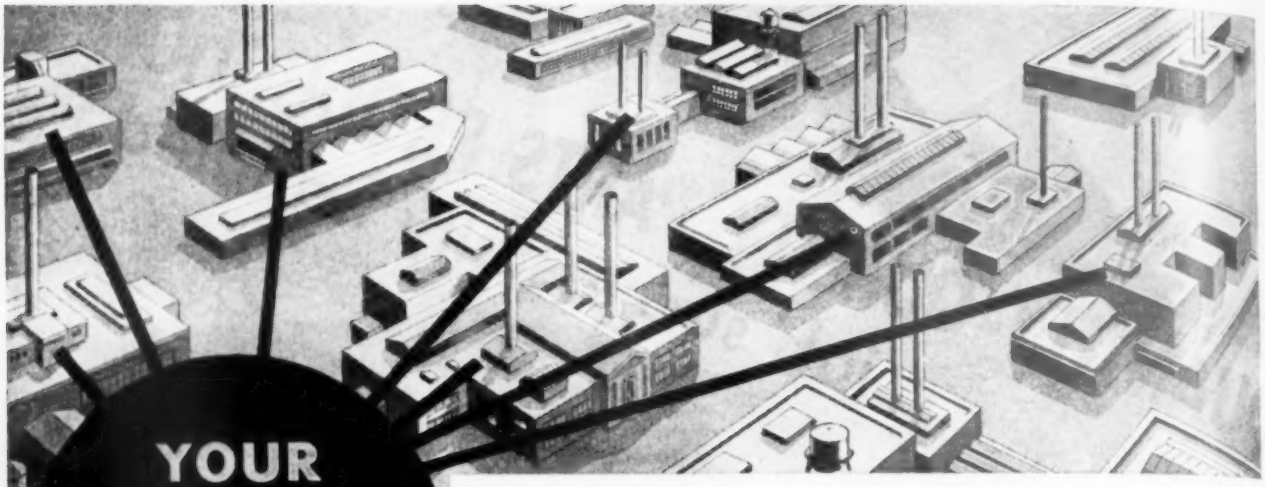
P&J began to prepare for today's needs more than forty years ago when it pioneered the development of automatic chucking machines.

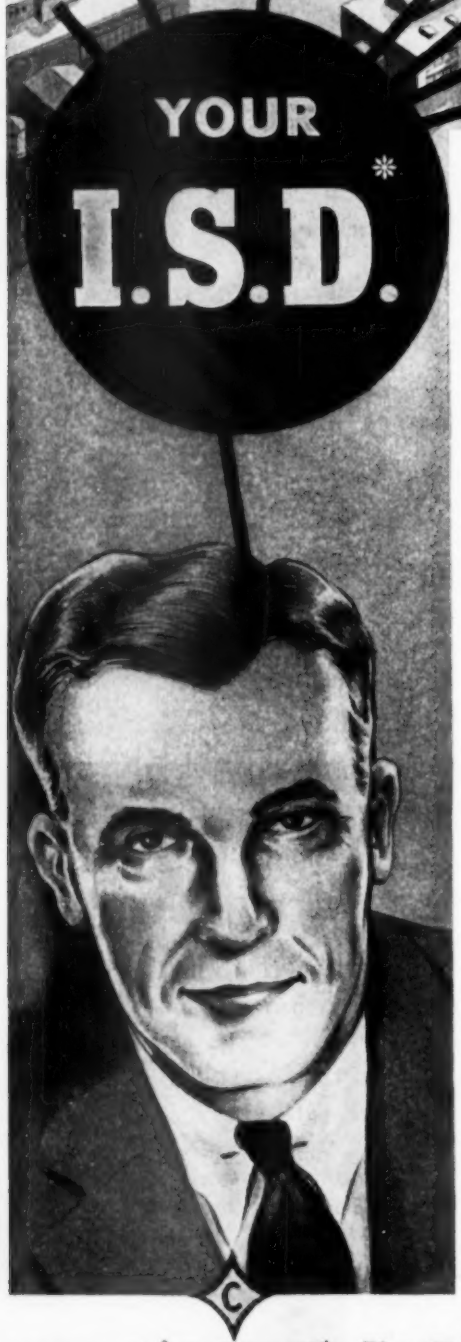


TURNING OUT MORE PARTS HERE WILL TURN THE TIDE "OVER THERE"

Buy More **WAR BONDS**

POTTER & JOHNSTON MACHINE CO.,
Pawtucket, R. I.





"Next Door" to Guaranteed Delivery When you order through your

I.S.D.*

Nobody can guarantee spot deliveries, of course. But your *Industrial Supply Distributor does the next best thing—he *anticipates* for you by ordering what you will need, ahead of the time you are going to need it.

He buys from many sources of supply, absorbing a lot of delays enroute and saving you clerical time and paper work. He buys on high priority as a rule. He buys for stock. That's why he can often say "Yes, sir—this afternoon, *sure!*"

Telephone your Industrial Supply Distributor INSTEAD of ordering materials or parts from the factory. You'll frequently find that this saves time for yourself—and avoids duplication and confusion—perhaps the very materials you need so urgently already are on the way to him on an order he placed weeks or even months ahead.

And you can buy from him with confidence always—we have been selling to him with confidence for many years. Try him FIRST for your needs in Cle-Forge High Speed Drills, Peerless High Speed Reamers, and other cutting tools we make.

ARMY NAVY

ARMY E NAVY

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1242 EAST 49TH STREET
CLEVELAND

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6515 SECOND BLVD., DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST., E.C.4

THEM!

You are looking at the Board of Directors of one of the busiest companies in the world. It is the firm of Gremlin, Widget & Finella, Inc.,* specialists in the new light-metal headaches — magnesium migraines, aluminum ailments and general alloy trouble.

As the Light Metal Age swings into mass production, this company finds itself with advance orders on hand for some of the biggest headaches in history, and already its record in the highly technical field of industrial interference is an impressive one.

One of the most notable achievements of G. W. & F. has been their handling of the weight factor in horsepower development. For years they have kept the ratio of pounds to horsepower high in all types of engines, and only the sheerest engineering genius has succeeded in producing one horsepower with slightly less than a pound of metal — yet 5 or even 10 horsepower may be possible with a pound of the right alloy.

Likewise, this new subsidiary of the Headache Trust has done some pretty whimsical and spectacular things with metal, causing magnesium dust to explode, and the metal to dissolve back into sea water like so much salt. Bearings have been known to crystallize within a few hours from vibration alone, and the ideal bearing surface is one so hard that the cost of working it is still a major headache.

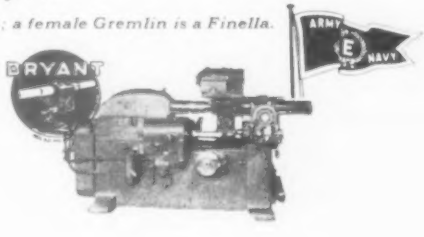
As specialists in internal grinding, we at Bryant have helped to cure many a new and serious headache in the working of light metals, super-hard alloys, and other new materials. We have helped to develop safer processes for machining light metals, improved methods of grinding and finishing the super-hard tungsten-content alloys, and new techniques for working such materials as hard rubber, glass, graphite, plastics, bronze and cast iron, as well as centrifugally cast steels and alloys from hundreds of new specifications.

If your business calls for the use of precision machine tools, Bryant's Consulting Service can be of greater value to you today than ever before. We urge you to "Send for the man from Bryant!"

Subsidiary of the Gremlin Headache Trust. A Widget is a young Gremlin; a female Gremlin is a Finella.

Bryant Chucking Grinder Co.

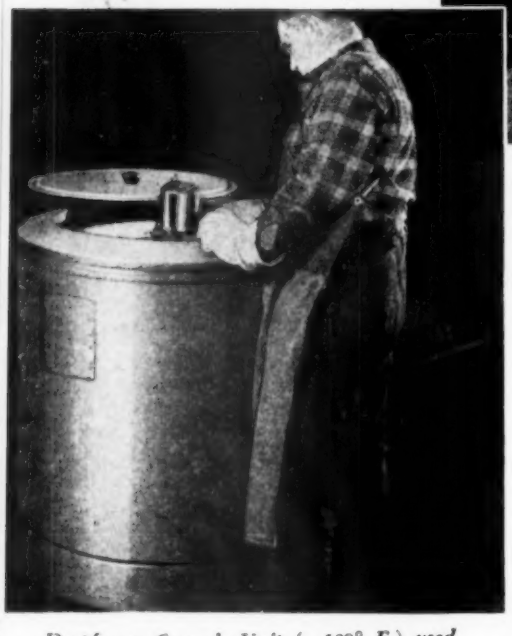
Springfield, Vermont, U. S. A.



SEND FOR THE MAN FROM BRYANT

NOW a faster, better way to get shrink-fit assemblies

(Above) Operator merely slips chilled plug into heated strut for a permanent shrink-fit assem



Deepfreeze Cascade Unit (−120° F.) used in shrinking plug for landing strut.

Deepfreeze METAL CHILLING SPEEDS ASSEMBLY OF LANDING STRUTS . . . ELIMINATES "FATIGUE" STRAINS

This is another excellent example of how intense cold (−120° F.) in conjunction with normal heating (+450° F.) has increased the production and improved the manufacture of airplane landing struts.

Formerly the female part of the assembly was heated with torches. This was unsatisfactory, because the torches did not impart a uniform heat nor was the heat intense enough for sufficient expansion. In addition, it was necessary to assemble the units with an arbor press which produced scratches in the mating surfaces... *dangerous future* fatigue and breaking points.

"Production Time Cut in Half"... Completes Operation in 10 Minutes

The barrel of the DEEPFREEZE Cascade Unit is filled with a non-inflammable solvent which does not freeze at −120° F. The plug is immersed in the liquid, while the female part is subjected to an oil bath of 450° F. and expanded .005". The plug is shrunk .0026", making it simple for the operator to insert the plug by hand. Total time for the entire operation is approximately 10 minutes.

The Uses of Deepfreeze in YOUR Plant

Deepfreeze sub-zero temperatures (as low as −120° F.) can help you in the following metal working operations.

1—Shrinking of metal for ease of bearing assembly, etc.

2—Testing of metals for reaction of sub-zero temperatures to aircraft instruments, etc.

3—Treating of metals for prevention of growth or warp in gauges, etc.

FREE ADDITIONAL DATA and proof of the outstanding success of the Deepfreeze method for chilling metals are included in this booklet. Write for *your* copy today.

DATA AND PART INFORMATION

Shrink-fit assembly of steel plug in airplane landing strut.

Diameter of Plug.....	3.880" / 3.879"
Diameter of Bore.....	3.875" / 3.874"
Shrink of Plug..	.0026" @ −120° F.
Expansion of Bore.....	.0050" @ +450° F.

FORMER DIFFICULTIES

Heating by torches did not impart uniform temperatures. Heating in oil bath alone did not produce sufficient expansion for assembly.

SOLUTION

The Deepfreeze Cascade −120° F. used on plug plus heating of bore results in permanent shrink-fit assembly, speeds operation.

Deepfreeze DIVISION

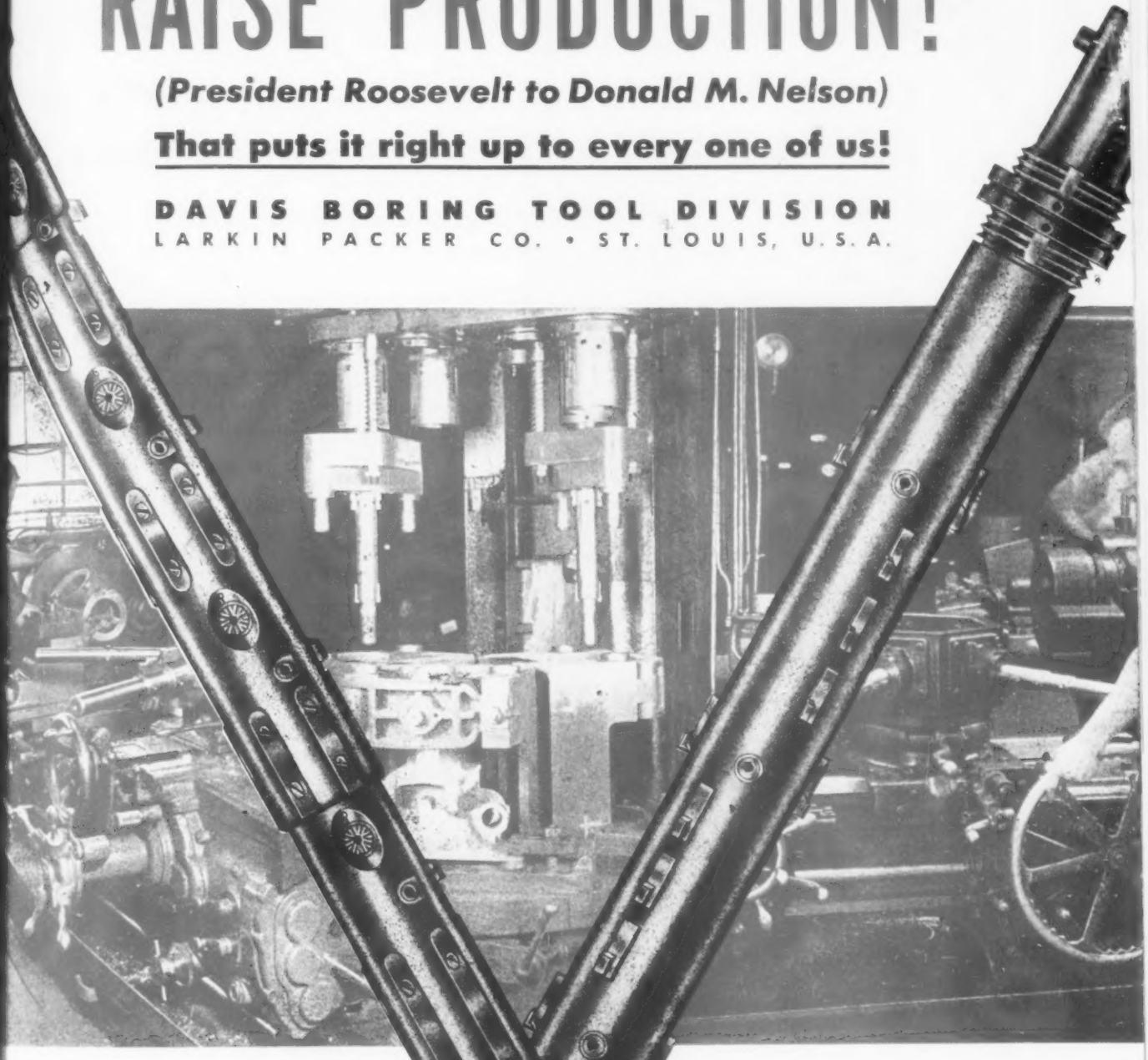
MOTOR PRODUCTS CORPORATION
2311 DAVIS ST., NORTH CHICAGO, ILLINOIS

"Take Every Possible Step to RAISE PRODUCTION!"

(President Roosevelt to Donald M. Nelson)

That puts it right up to every one of us!

DAVIS BORING TOOL DIVISION
LARKIN PACKER CO. • ST. LOUIS, U.S.A.



DAVIS
BORING TOOLS

SALVAGE YOUR DULL, WORN *rotary files*

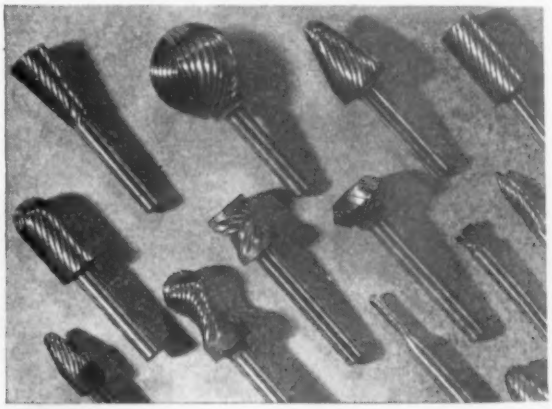
CONVERT THEM INTO SHARP MIDGET MILLING CUTTERS

There's good tool steel in those old, worn rotary files in your plant. In fact it's so good that we can convert dull rotary files into perfect Midget Milling Cutters. The cost to you is 65% off list of Severance new-tool price. SO NOW IS THE TIME TO HELP SALVAGE AMERICA'S PRECIOUS SUPPLY OF TOOL STEEL. Send us your dulled rotary files to have us regrind them into hard-biting, sharp-cutting Midget Milling Cutters.

●

NEW SEVERANCE MIDGET MILLING CUTTERS

Standard finishing tools for every type of metal and alloy, wood and plastic are being made today by Severance to help speed up your production. Inside and outside deburring cutters, chatterless countersinks, chatterless seating and facing cutters, electrode dressing cutters, reamers and special tools of every type are available. Write for complete information on all standard Severance Midget Milling Cutters and special tools.



Severance

MIDGET MILLING CUTTERS • PRECISION REGRINDING
SEVERANCE TOOL INDUSTRIES, INC., SAGINAW, MICH. •
PLANTS IN LONG ISLAND CITY, N.Y.; DETROIT, MICH.;
FORT WAYNE, IND.; CHICAGO; AND LOS ANGELES

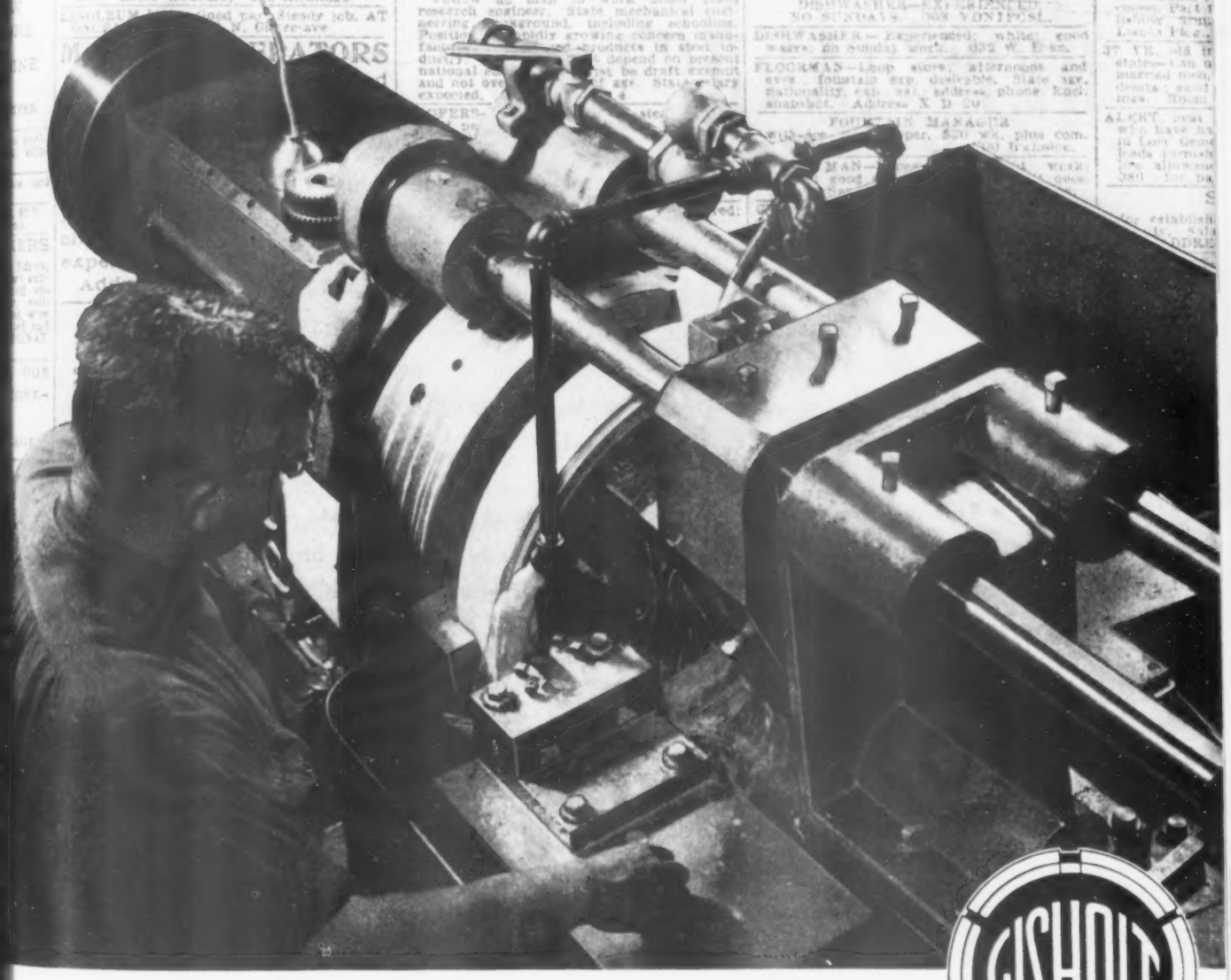
PREVIOUS EXPERIENCE NOT NECESSARY

GISHOLT SIMPLIMATIC LATHES require very little operator training. All functions of this machine are entirely automatic. The operator merely loads and removes the work.

Such simple, automatic operation makes it possible for one man (or woman) to tend two or more Simplimatics.

With multiple cutting and its swift cycle of operations, the Simplimatic produces continuously, accurately—at a brisk pace that no skilled machinist could ever equal.

GISHOLT MACHINE COMPANY • **East Washington Avenue, Madison, Wisconsin**



LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS IN METAL TURNING

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

GISHOLT

NEW HANDS! — *all thumbs!*

Awkward, untrained hands, however willing, need the help of tools which simplify and speed up machine operations on precision parts — such tools as **HECKER** designs and builds.

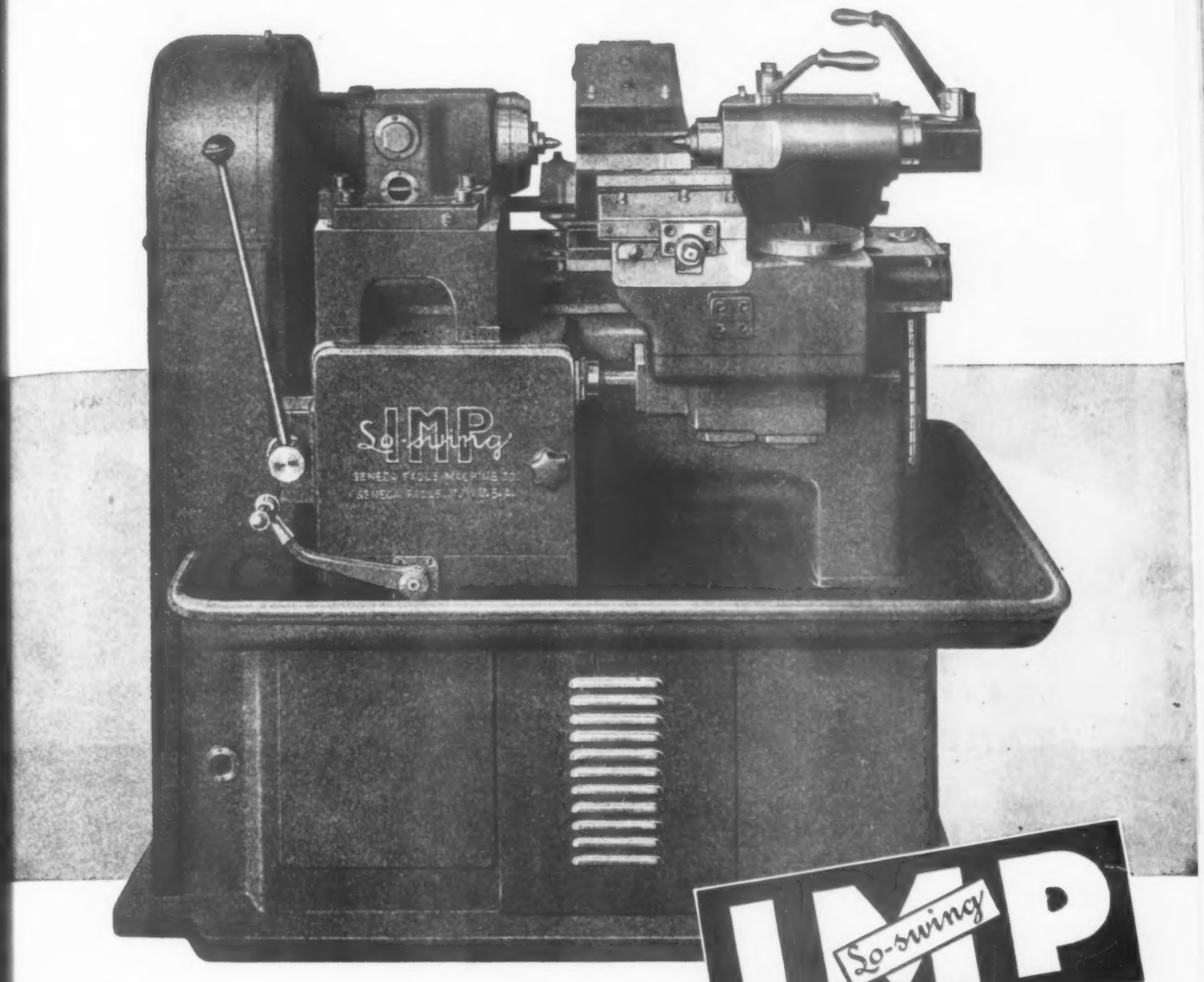
You can reduce the training and "breaking in" period for less experienced workers with **HECKER** tools, jigs and fixtures. Our engineers are familiar with this problem. They see it at close range in our own production of precision parts for well-known aircraft manufacturers. They can help solve the same problem in your plant by designing extra "skill", accuracy and simplicity into **HECKER** tools for you.

This organization of top-flight tool engineers and specialists welcomes a trial on one of your tooling problems. There's no better way to prove, to your own satisfaction, that **HECKER** can help you speed up production, whether your workers are new hands or old heads. Write A. W. Hecker, 1988 East 66th Street, Cleveland, Ohio, or 517 New Center Building, Detroit, Michigan.

A★W★ *Hecker*

DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES . . . FABRICATORS OF AIRCRAFT PARTS

A MODERN FULLY-AUTOMATIC LATHE



THE *Lo-swing* IMP Lathe now incorporates many new features, several of which can be credited to the wide experience gained in war production. For small work demanding high speeds, fine finishes and extreme accuracy, the IMP has earned an enviable reputation. Its sturdy, compact design makes it likewise suitable for turning heavier work such as small pistons, bushings, gear blanks, etc.

Because of its integral unit design, the *Lo-swing* IMP lends itself to practically unlimited tooling possibilities. A Third Slide or Over-arm is available for additional facing, grooving and chamfering operations—either roughing or finishing.

A recently issued Bulletin, No. N 42, fully describes this versatile lathe. Write for your copy today.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

IMP Lo-swing

. . . WITH

- SIMPLIFIED CHANGE-OVER MECHANISM.
- SMOOTH, HIGH-SPEED DRIVE THRU MULTIPLE "V" BELTS.
- SPINDLE MOUNTED ON SELECTED PRECISION BALL-BEARINGS FOR SPEEDS UP TO 5000 R. P. M.
- FINE FEEDS FOR DIAMOND TURNING.
- UNIQUE HEAD AND TAIL-STOCK DESIGN PERMITS CARRIAGE SLIDE TO PASS BY.
- MANY FEATURES THAT REDUCE SET-UP TIME.

LATHE NEWS from SENECA FALLS

Keep 'em Cutting with tools that last longer

★
RIGHT HAND—SHOWN
LEFT HAND—OPPOSITE

★
RIGHT HAND—SHOWN
LEFT HAND—OPPOSITE

Super

CARBIDE-TIPPED

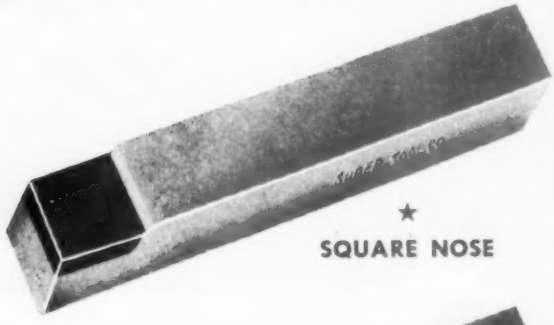
STANDARD TOOLS

available for

QUICK DELIVERY

For turning, boring and facing operations, here are tools engineered and manufactured by Carbide-Tool specialists to do the job accurately throughout a long period of use. Prompt delivery made from our stock of standard sizes in two grades: for general purpose cutting and for cutting steel.

Write for New General Catalog



★
SQUARE NOSE

★
ROUND NOSE

SUPER TOOL CO.

21650 Hoover Road
Detroit, Michigan

Carbide Tipped Tools

FOR TURNING • FACING • REAMING • SPOTFACING • BROACHING
FORMING • GRINDER RESTS • WEAR PARTS • BORING • MILLING • DRILLING
GROOVING • COUNTERBORING • SHAVING • CENTERS • SPECIAL PURPOSES

Night Raiders—

Into the black and spaceless night go America's avenging Air Raiders—dependent for their sight, sound and slugging power on precision instruments and controls made by such famed manufacturers of aircraft precision equipment as Sperry, Bendix, Kollsman, Norden and others.

Today every available Ceco Automatic Universal Precision Screw Machine is at work helping to produce, economically and at high speed, the extremely accurate precision parts for the amazing mechanical "brains" which guide our gallant sky fighters from take-off to target—and back again.

That is where Ceco Automatics come in and stay in until Victory.

AFTER VICTORY

Ceco Automatics will serve the makers of instruments, controls, appliances and devices which will bring to a post war world a new era of comfort and efficiency.

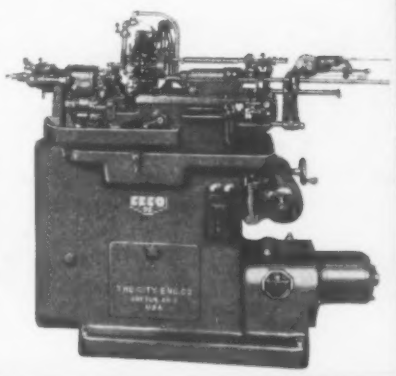
CECO'S OUTSTANDING ADVANTAGES

XTREME ACCURACY. Ceco holds tolerances to .0003".

PROVED ECONOMY. In many cases Ceco produces a ished piece from bar stock without a second operan for finish and tolerance.

GH SPEED. Ceco has a Master Speed Ranger ich gives from 680 to 7500 R.P.M. spindle speed the turn of a handwheel. No changing gears, ts or pulleys. Ceco's Cam Shaft has a range of m 3 seconds to 8 minutes. No gears to change.

MPLICITY. Ceco's Precision Roller Bearing Spindle always in adjustment. Operates at faster speed runs cool at high speed. Ceco's Constant Rise ding mechanism gives more accurate feeding.



CECO

SWISS TYPE *Automatic*

UNIVERSAL PRECISION SCREW MACHINES

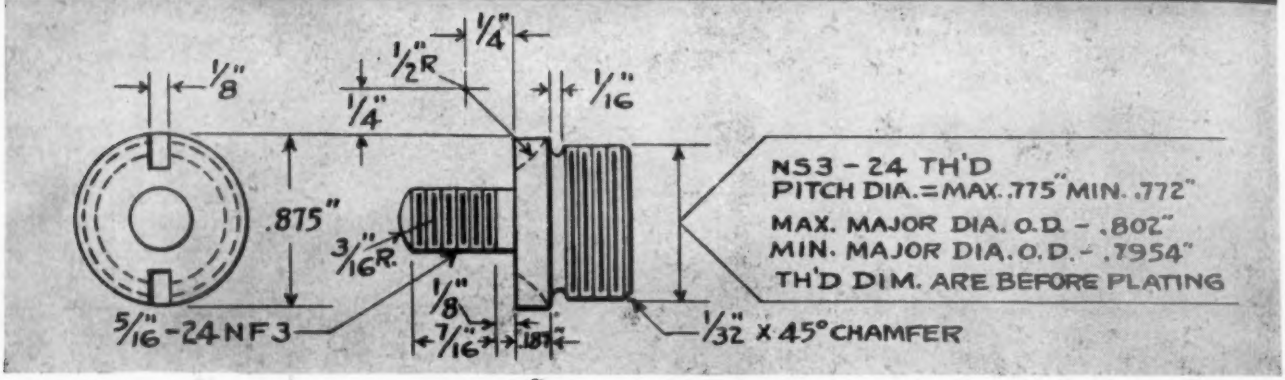
Engineered and Manufactured by
THE CITY ENGINEERING COMPANY
Dayton, Ohio

Since 1909, Designers and Builders of Tools, Dies, Fixtures and Special Purpose Machinery.

TANTUNG

THE MIRACLE METAL

COMPARATIVE PERFORMANCE SHOWING THE ADVANTAGE OF USING TANTUNG IN SCREW MACHINE OPERATION



NAME: PLUG
MATERIAL: S.A.E.-120

MACHINE: CLEVELAND AUTOMATIC and *W&S #4 COOLANT OIL

Operation: TURN, FORM, THREAD THREAD, CUT OFF

TOOLING	ACTUAL TIME	PIECES PER HOUR	COST PER 100 PIECES	SPEED
*HIGH-SPEED STEEL	3.55	16.9	$5.92	320
HIGH-SPEED STEEL AND TANTUNG	2.85	21.0	4.76	560
TANTUNG	1.55	38.7	2.58	800

NOTE—Tantung shows its unquestioned superiority over high-speed steel. Analysis shows when Tantung tools were used exclusively—PRODUCTION was more than doubled—129%—TIME—more than halved—55.7%—COST cut more than in half—56.4%.

Tantung is not a substitute for carbides. Use where carbides cannot be used. Tantung is a hard, tough, cast, non-ferrous alloy. Its efficiency and outstanding performance is made possible by the inclusion of tantalum carbide. Send for Tantung Performance Data Book.

TANTUNG • ECONOMY • ALL PURPOSE • CUTTING OFF • SPECIAL TOOLS • SOLID TOOL BITS • MILLING CUTTER BLADES

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Ramet

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS • DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES
IN CANADA: CARBIDE TOOL AND DIE COMPANY, LTD., HAMILTON, ONTARIO

MORE POWER LESS WEIGHT

MEANS

MORE WORK – LESS FATIGUE

ACTUAL SIZE

Power a-plenty in ARO Pneumatic Tools for a great variety of small tool jobs—yet ARO Engineering has packed this power into a surprisingly small unit!

By doing jobs of drilling, nut-setting, screw-driving, grinding, sanding and similar operations formerly requiring larger tools, ARO sets a new standard of *greater production with less fatigue.* Ideal for today's needs—especially for women operators!

Simple in design... Rugged ...Dependable... Stall-proof... Light in weight. Send for complete new catalog or see your ARO Jobber.

THE ARO EQUIPMENT CORPORATION, BRYAN, OHIO

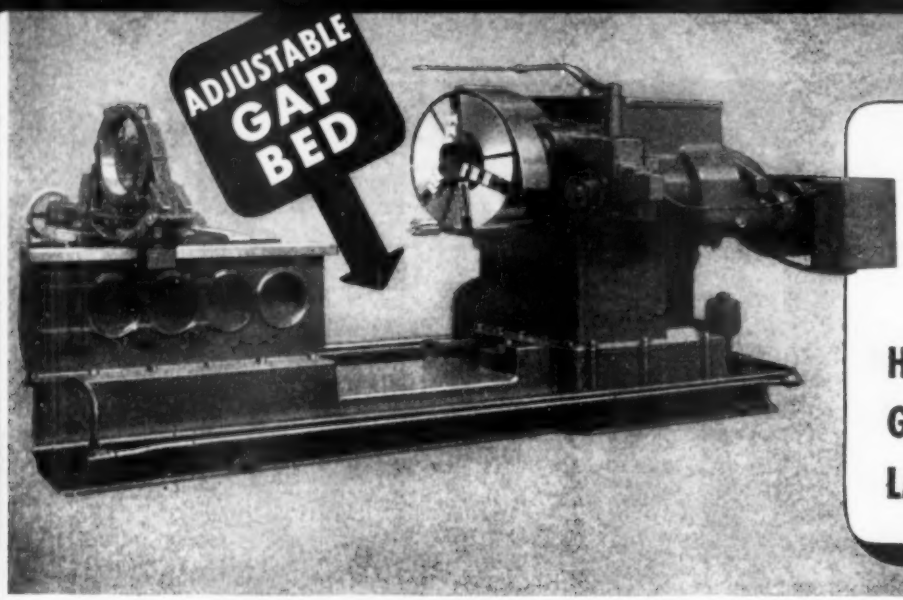
Pneumatic Tools... Lubricating Equipment... Aircraft Products

ARMY E NAVY

THE ARO EQUIP. CORP.

PNEUMATIC ARO TOOLS

BRYAN, OHIO

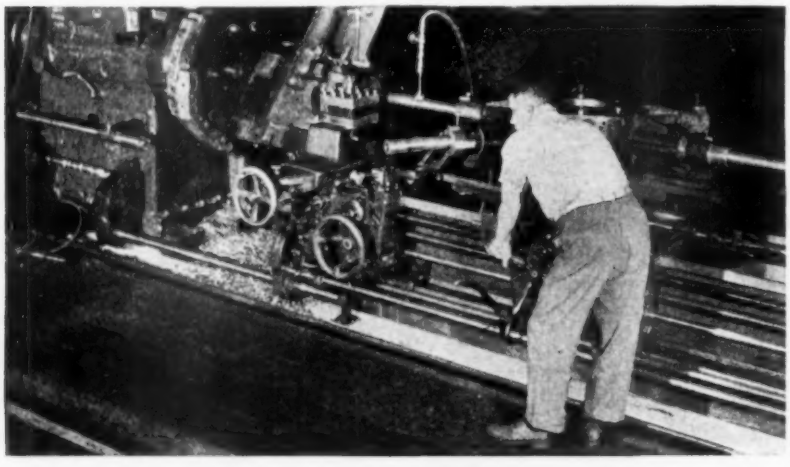


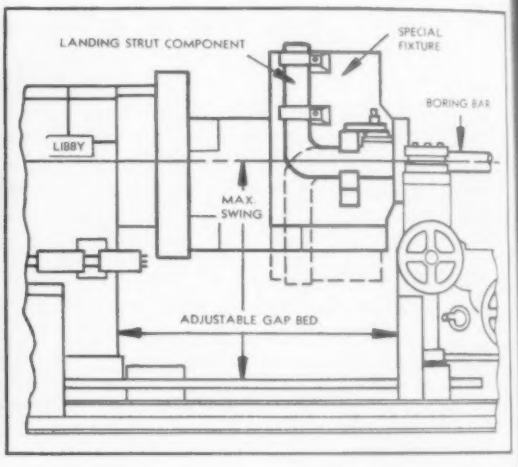
Libby

HEAVY DUTY, SLIDING BED GAP TURRET LATHES HANDLE LARGE, UNWIELDY WORK...

For Turning and Boring Operations on Large Non-Symmetrical Parts

The Heavy Duty Sliding Bed Gap Turret Lathe, an innovation of the Libby Division of the International Machine Tool Corporation, is proving an outstanding advantage in plants manufacturing landing gear struts, wheel forks, large Navy valves, etc. The additional swing—84″—provided by the adjustable gap bed permits the machining of parts having angular extensions or non-symmetrical shapes. In addition, the gap may be closed, converting the machine to a conventional turret lathe permitting the use of both tool post and turret tools.

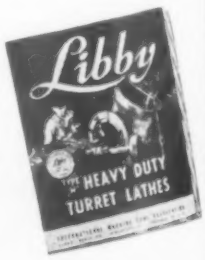




Here is a typical application of the Sliding Bed Gap Turret Lathe . . . machining airplane wheel forks. The bed is adjusted by power to hold the gap width to a minimum for the work at hand. If need be, the gap may be widened to 44″ from the face of the chuck on this machine. After positioning, the adjustable bed is rigidly held by large clamps and bolts to the heavy cast iron sub-base.

In this operation the wheel fork is mounted on a large special fixture which weighs approximately 3,000 lbs. The parts are solid steel forgings and are machined from each end, performing turning, boring, drilling and radius forming operations. The end shown was completed in 1 hour and 20 minutes.

Our engineers, specialists in turning and boring large, heavy work, will be glad to make suggestions for handling parts of this nature on turret lathes without obligation.



THIS FREE BOOKLET contains additional information concerning other valuable features of the Libby Heavy Duty Turret Lathes...write for your copy today. Write to the Libby Division, 1130 W. 21st Street, Indianapolis, Indiana.

INTERNATIONAL MACHINE TOOL CORPORATION

LIBBY DIVISION, INDIANAPOLIS, INDIANA · FOSTER DIVISION, ELKHART, INDIANA

MAIN OFFICE AT ELKHART, INDIANA

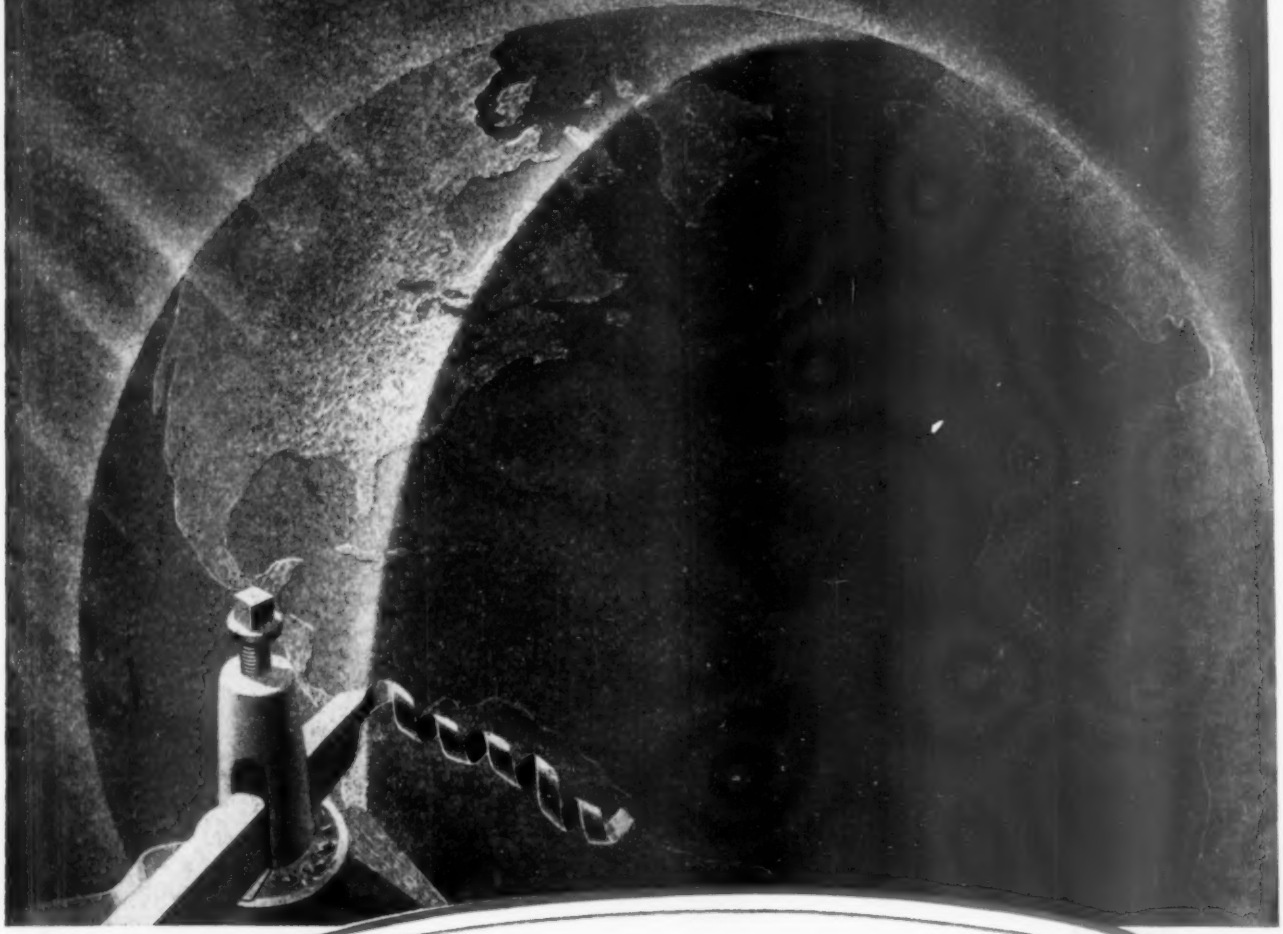
FOSTER FASTERMATICS · LIBBY HEAVY DUTY TURRET LATHES · STANDARD TOOLS
SUPERFINISHING MACHINES · BARKER CHUCKS · UNIVERSAL BAR TYPE TURRET LATHES

New Bench Model
Automatic Bucker
For Production Riveting

AERO TOOL CO
Now one person both bucks and rivets in one operation FASTER, BETTER, EASIER
Another Aero Tool FIRST
SEND FOR BULLETIN ON YOUR FIRM LETTERHEAD
CABLE ADDRESS AERO

AERO TOOL COMPANY • BURBANK, CALIFORNIA

CUTTING A PATH... *TO VICTORY*



FROM the threat of abysmal global darkness, our world is gradually emerging into the Light of Freedom. The prospect of eventual Victory is but a reflection of America's collosal and unequalled capacity for production . . . *a record output that would be impossible without TOOLS!*

• LATROBE is proud to play its role through the development of quality high-speed steels, so vital to Industry's manifold cutting operations.

The service of Latrobe's highly specialized organization is at the command of every tool producer . . . with modern research, skilled engineering and timely technical assistance.

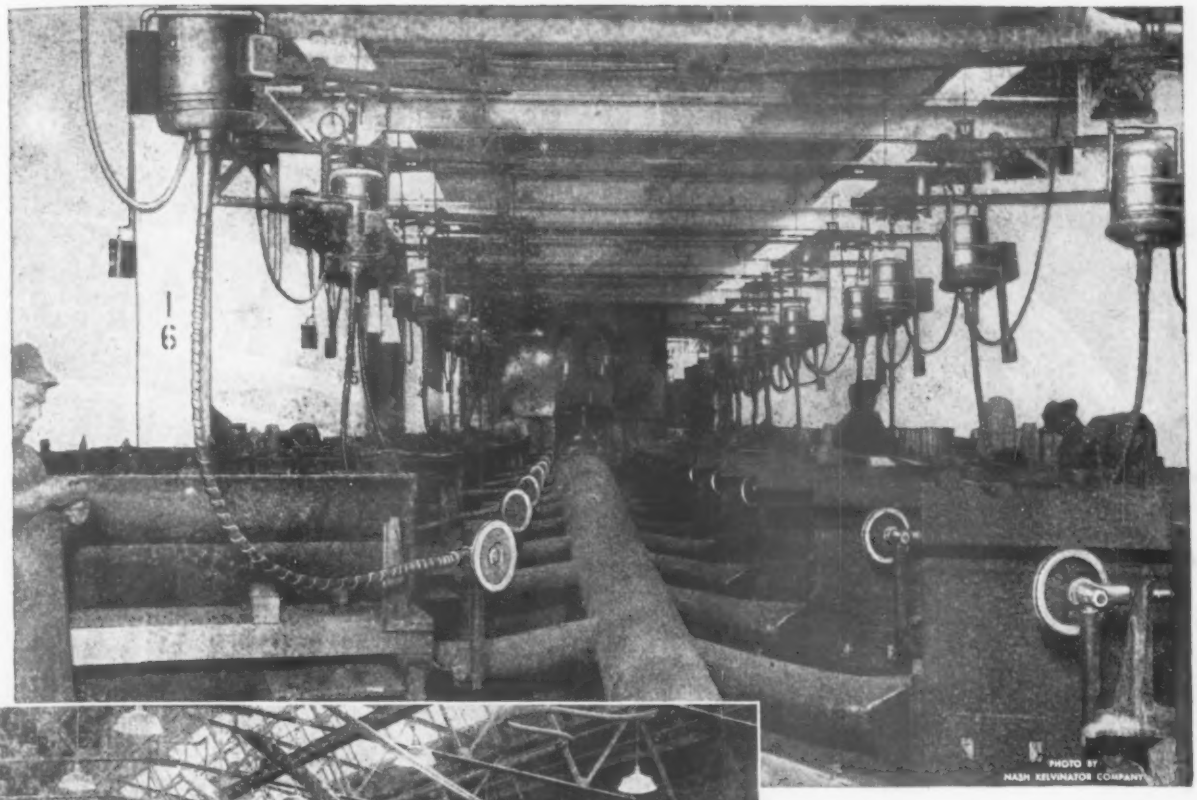
LESCO

HIGH SPEED STEELS FOR VICTORY

LATROBE

ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT . . . LATROBE · PA·



Jarvis POWER TOOLS

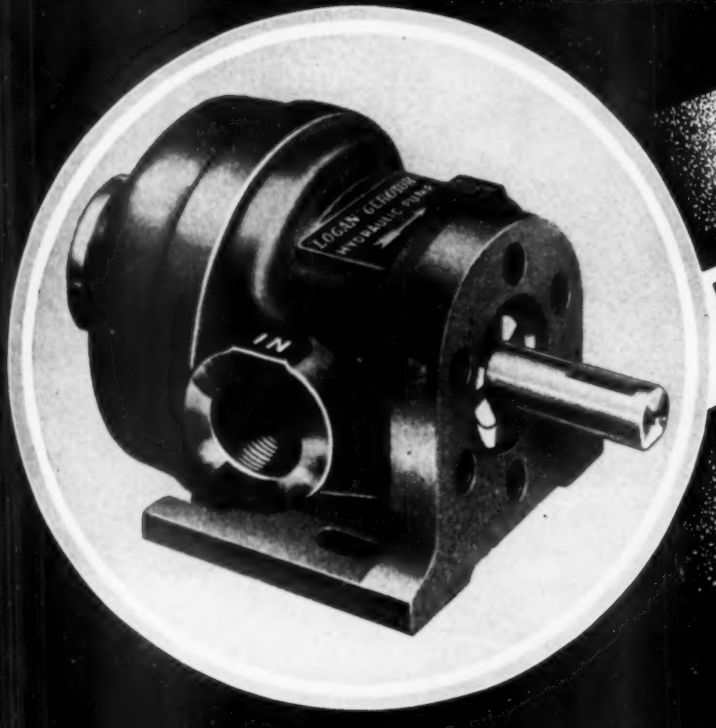
Hundreds of these Jarvis Propeller Sanding, Polishing and Buffing Machines are working around the clock. They speed the production of aircraft propellers in all the leading propeller plants of the Nation.

THE CHARLES L. JARVIS CO., MIDDLETOWN, CONN.

TAPPING ATTACHMENTS • FLEXIBLE SHAFT MACHINES • GROUND ROTARY FILES

"LOGAN"

GEROTOR HYDRAULIC PUMPS



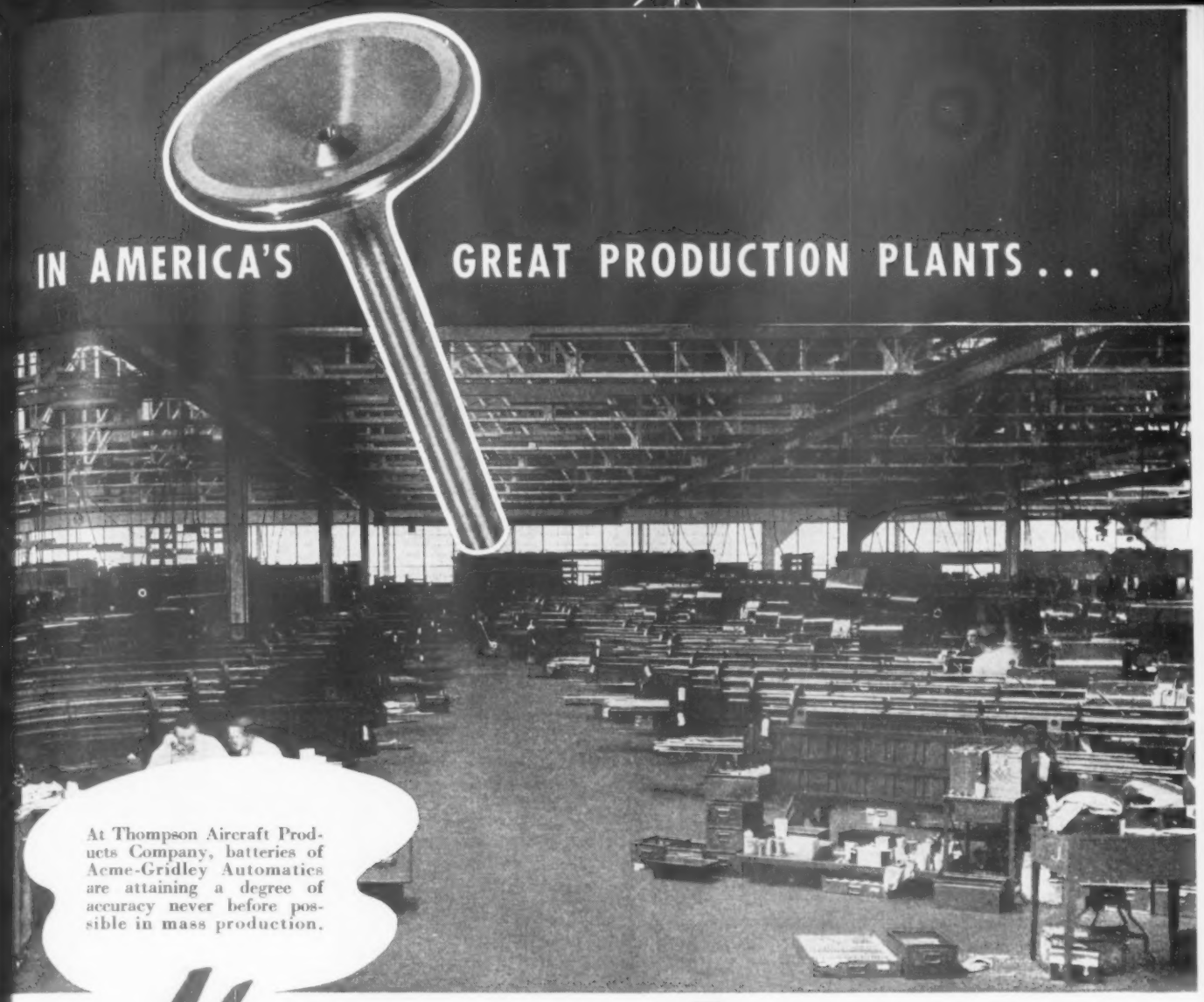
• A COMPLETE LINE OF 1000 P. S. I. OIL HYDRAULIC PUMPS RANGING in CAPACITIES FROM 3/4 to 30 G.P.M.

WRITE FOR *New "LOGAN"* GEROTOR BULLETIN 480

LOGANSPORT MACHINE, INCORPORATED

902 PAYSON ROAD LOGANSPORT, INDIANA

★ MANUFACTURERS OF AIR AND HYDRAULIC DEVICES, CHUCKS, CYLINDERS, VALVES, PRESSES AND ACCESSORIES ★


IN AMERICA'S GREAT PRODUCTION PLANTS . . .
At Thompson Aircraft Products Company, batteries of Acme-Gridley Automatics are attaining a degree of accuracy never before possible in mass production.

Millions of Parts—QUICK!

Two and three times faster than they have ever been produced before, metal parts in great variety, machined with the utmost precision—those are the demands of a war production greater than any nation has ever met!

Acme-Gridley Automatics are turning out these parts, at speeds and feeds limited only by the capacity of tools to stand up under 24-hour schedules.

These 4, 6 and 8-spindle machines are quickly adapted to many classes of work, often as many as 20 operations on a single set-up. Large tooling area speeds setting up. Operation is convenient, output is uniform, costs are low.

And when industry goes to work on the growing backlog of peace-time needs, Acme-Gridleys will be ready to carry their full share of the load—at lower costs than ever before.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

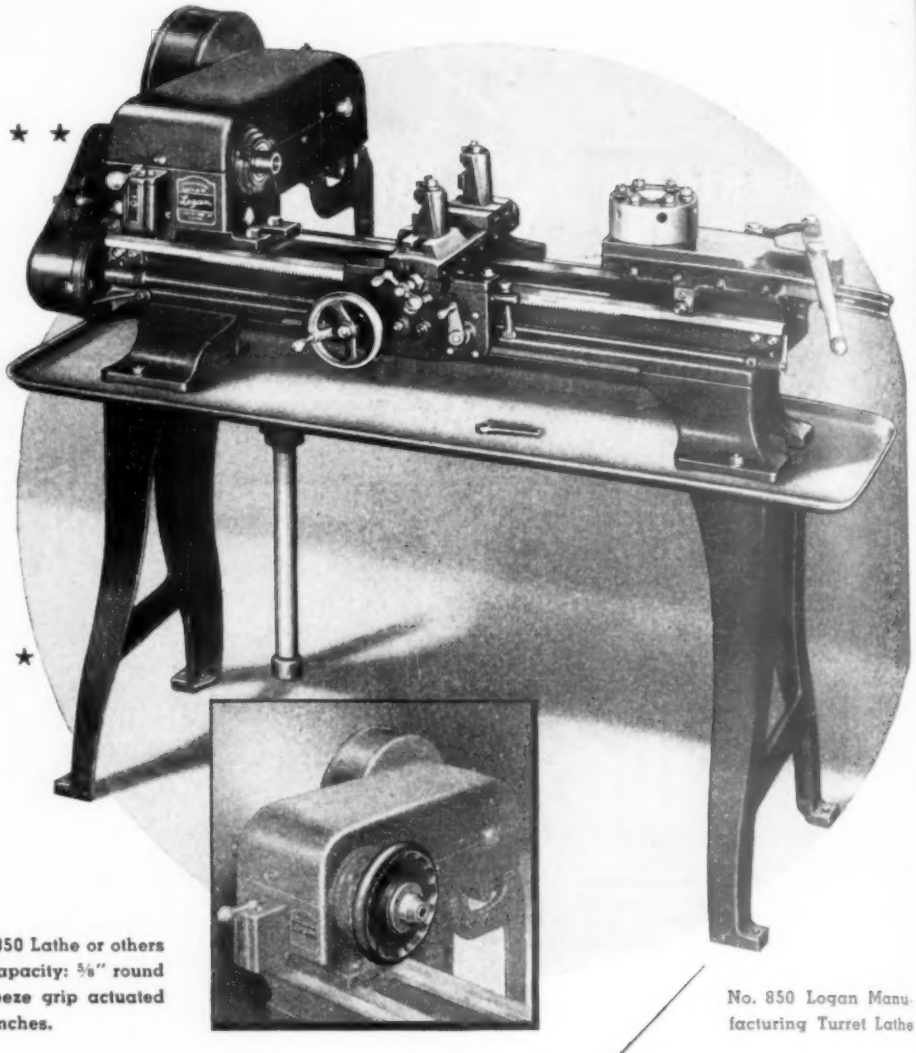
ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SPECIFICATIONS

- Swing Over Bed, 10"
- Bed Length, 43⅛"
- Spindle Hole, 25/32" Capacity, ⅝"
- Pre-Loaded Precision Ball Bearing Spindle Mounting
- 12 Spindle Speeds, 30 to 1450 R.P.M.
- Cross Slide Stroke, 3¼"
- Six-Position, Automatic Indexing Turret
- Stroke of Turret, 4¼"
- Precision Ground Ways: 2 Prismatic V-Ways and 2 Flat Ways

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



Logan Speed Collet Chuck for the No. 850 Lathe or others with a 1½" x 8-thread spindle nose. Capacity: ⅝" round bar stock. Quick acting. Positive squeeze grip actuated by plastic hand wheel. No keys or wrenches.

No. 850 Logan Manufacturing Turret Lathe

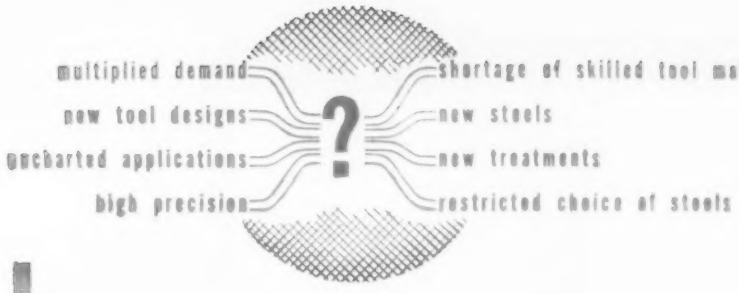
AN ACCURATE TURRET LATHE for SMALL PARTS PRODUCTION

Developed to meet war industry's urgent need for a fine tool capable of continuous production with sustained accuracy, the No. 850 Logan Turret Lathe has surpassed all expectations. Within the limits of its capacity (⅝" round bar stock) it will turn out parts with the same precision, and with equal or greater speed as that of heavier equipment, which can be released for larger work. And, of course, the investment and operating costs are proportionate to its size. *Complete description and specifications on request.*

LOGAN ENGINEERING COMPANY • Chicago, Illinois

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES



Aid on wartime tool steel problems

Top speed war production demands TOOLS — *more* tools than dreamed of in peace time — ***new kinds*** of tools for new war time jobs. The tool industry is tackling this tremendous task short of skilled tool makers and restricted by shortages in their choice of steels.

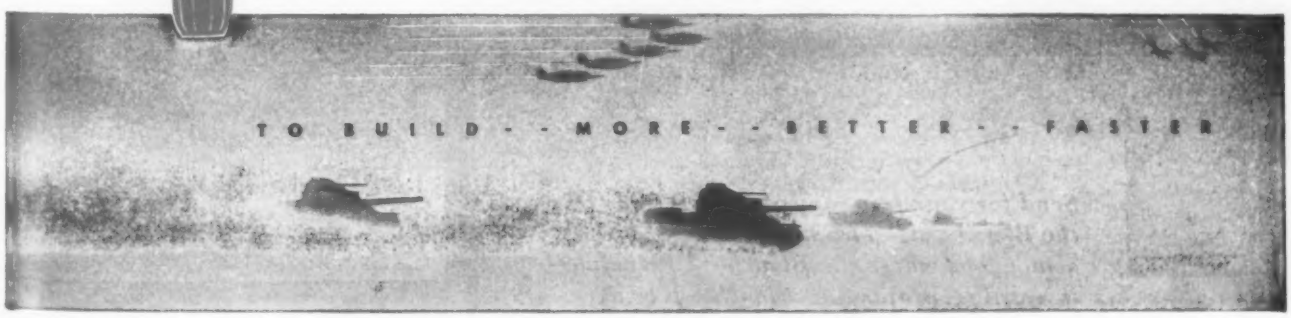
Solutions to these new problems are being worked out every day by the tool industry. Frankly, we don't have all the answers but our contacts with American tool makers determined to win this war puts us in a position to assist you in finding solutions to some of the particular problems that may be facing you.

On your problems of steel selection and treatment of tool steels, we would be very glad to have you get in touch with us. For your convenience, we are listing below the addresses of our district offices.

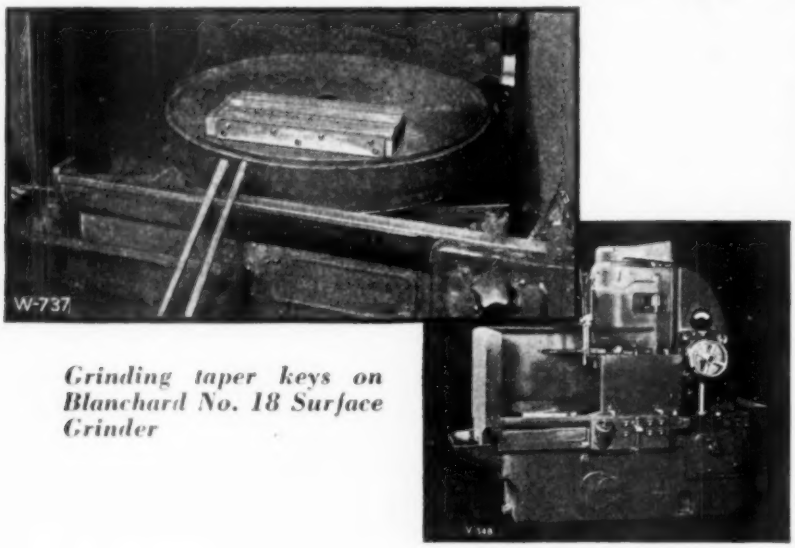
COPPERWELD STEEL COMPANY · WARREN, OHIO

COPPCO TOOL STEELS

BUFFALO	1127 Liberty Bank Building	Washington 7283
CHICAGO	122 S. Michigan Avenue	Harrison 1411
CLEVELAND	1158 Union Commerce Building	Cherry 1326
DETROIT	7-251 General Motors Building	Trinity 1-1760
NEW YORK	117 Liberty Street	Cortlandt 7-8314



PUT IT ON THE BLANCHARD



Grinding taper keys on Blanchard No. 18 Surface Grinder

EVEN though fixtures are sometimes necessary on a Blanchard Surface Grinder, a simple design is often very satisfactory. A simple tapered shoe is used for holding 16 tapered keys in the set-up shown above. ¼″ to ½″ of stock is removed from one side of each key to limits of .002″. 48 pieces are ground per hour.

If greater production is required, two fixtures could easily be accommodated on the 36″ magnetic chuck. Magnetism holds the fixture on the chuck and helps to hold the work down in the fixtures.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
★ Adaptability
Fixture Saving
Operation Saving
Material Saving
Fine Finish
Flatness
Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

HIGH PRODUCTION THAT SPEEDS WINNING

PRECISION is the "secret weapon" that flies "into the blue horizon" with the fighting lads who man American-made planes.

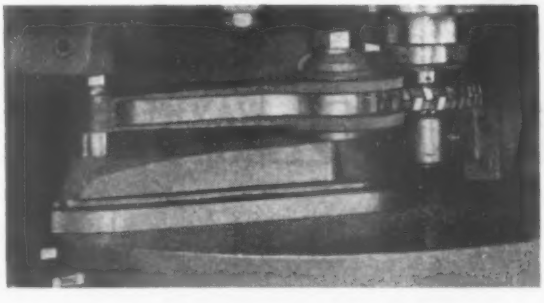
In America's aircraft plants and other metal-working industries, high speed automatic machinery specially designed and built by Davis & Thompson, has advanced new standards of precision and speed . . . higher precision parts, in greater numbers, are being made faster than ever before in history.

Fortified by many years of pre-war experience, Davis & Thompson engineers are boosting production by creating multiple-spindle boring, drilling, milling machines and other high speed precision units . . . rugged, compact, hydraulically operated, fully automatic machines to meet specific requirements.

Write for copy of the book,
"VICTORY PRODUCTION"

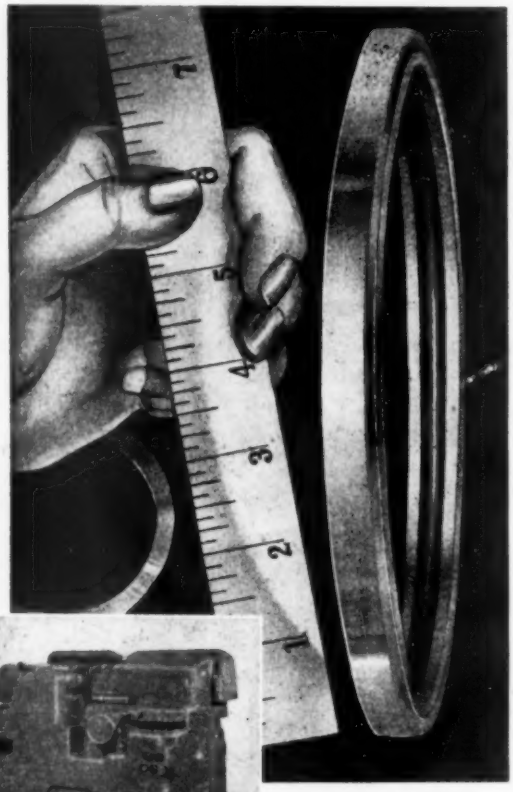
DAVIS & THOMPSON COMPANY
Milwaukee, Wisconsin, U. S. A.

BUY MORE U. S. WAR BONDS!



The machine shown here, for instance, automatically completes approximately 20 steps in the process of rough and finish-milling on aircraft engine connecting rods, on a single setup, with unvarying precision and speed that cuts production time down to a fraction of former methods. This uniform accuracy simplifies final inspection, precludes rejections, saves vital metal and manpower. The operator merely touches the proper control buttons on this hydraulically operated machine and ultra-automatic devices activate the complete operating cycle.

D&T ROTO-MATIC HIGH PRODUCTION MACHINERY



BIG OR LITTLE

LANDIS GRINDS THEM FAST

Both races illustrated are used in the manufacture of aircraft. That means production is of vital importance. One measures 7 ⅛" in diameter, while the other measures only ⅜". However, this presents no problem because by using the Landis No. 1 and Landis No. 2 Race-A-Way Grinders, these, and the many sizes of races in between can be productively ground.

One manufacturer uses Landis No. 1 Race-A-Ways for grinding the inner raceways of No. 203 outer races. Production averages 250 pieces per hour per operator. Another manufacturer uses Landis No. 2 Race-A-Ways for grinding the inner raceways of No. 207 outer races. Each machine grinds an average of 103 races every hour with one man operating two machines.

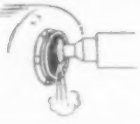
When you consider that in most cases one operator can handle two machines, you can understand why Landis equipment means added production, whether your races be large or small.

Unusual Performance
As Usual

PRECISION LANDIS GRINDERS

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.

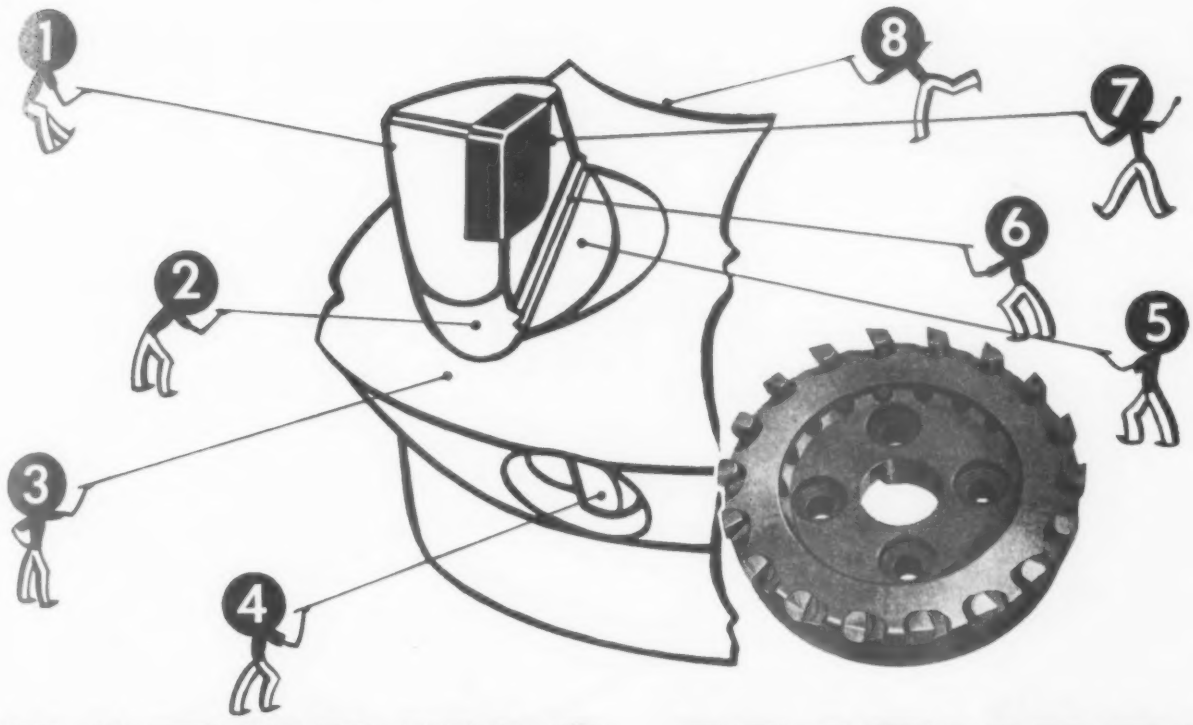
AUTOMATIC GRINDING CYCLE



SPINDLE SPEEDS UP TO 50,000 R.P.M.

AUTOMATIC WHEEL RESET

389



FEATURING FEATURES

OF LOVEJOY TYPE "A" MILLING CUTTERS

Lovejoy type "A" inserted-tooth Milling Cutters have features that put them in a class with solid mills regarding strength and rigidity—and in a class by themselves regarding convenience, production and economy.

1 Rugged support for cutting edge of blade — whether it is solid High Speed Steel, Stellite, Rexalloy or Tungsten Carbide.

2 Round hole in housing eliminates tendency to fracture under coarse feeds at high speeds.

3 Tough forged steel housing.

4 Positive locking device for blade makes it easy to compensate for wear and grinding.

5 Finely serrated blade and shoe guarantee minimum metal removed from blade when resharpening.

6 Serrations are on the front of the blade—not on the back, or locating side.

7 Lovejoy blades are interchangeable over a wide range of sizes. High Speed Steel, Cemented-Carbide, Stellite, and Rexalloy blades are carried in stock for immediate shipment.

8 Bores are precision ground concentric with the face of the cutter.

There is a complete line of Lovejoy positive-locking Milling Cutters to meet every requirement—details and specifications will be found in the Lovejoy Catalog. Send the coupon today!

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

Please mail me the 24-page Lovejoy catalog covering the full line of Lovejoy Mills.

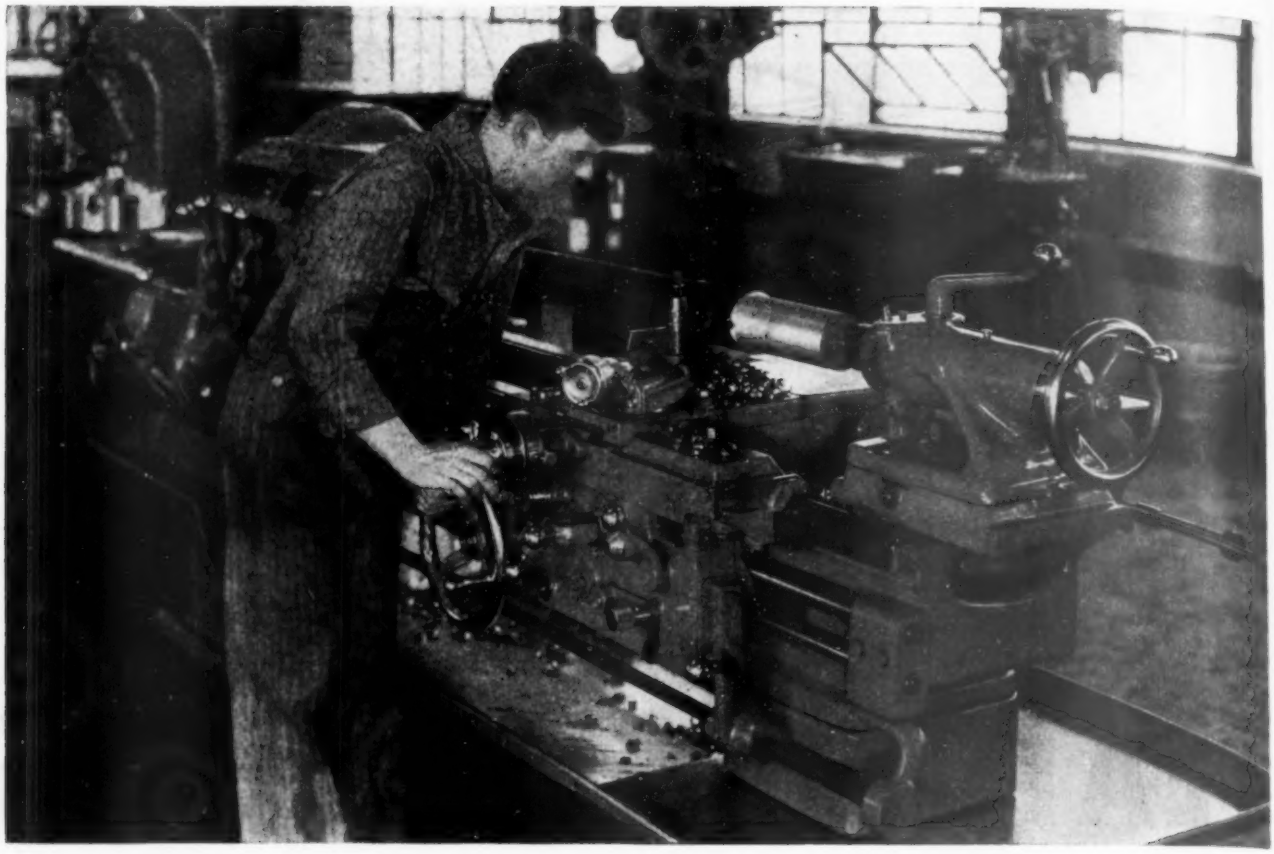
NAME.....TITLE.....

COMPANY .....

STREET .....

CITY.....STATE.....

T.E.



EXPERTS *not required!*

You can train inexperienced men or women in a comparatively short time to obtain quantity and quality production on Monarch lathes without undue fatigue. This is because Monarch engineers have always considered *simplicity of operation* to be a basic factor of design.

Such characteristics as simplified control of speeds and feeds and thread chasing . . . ease of mounting plates, chucks or fixtures on spindle . . . automatic lubrication of all major units . . . large diameter, direct reading micrometer dials and other features remove the strain of learning, shorten training periods and result in more rapid progress toward quality production.

With this background, operators can take quick advantage of Monarch production lathes, toolmakers' lathes, Monarch-Keller automatic forming turning machines and Monarch automatic sizing lathes, all of which are doing important war work in plants throughout the world.

With the pressure on all of us to produce "faster for fighters", we suggest that you review the versatility of Monarch lathes and the wide variety of work which they can do in your plant as they are doing so successfully in other plants. If our engineers can help you, they are at your service.

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

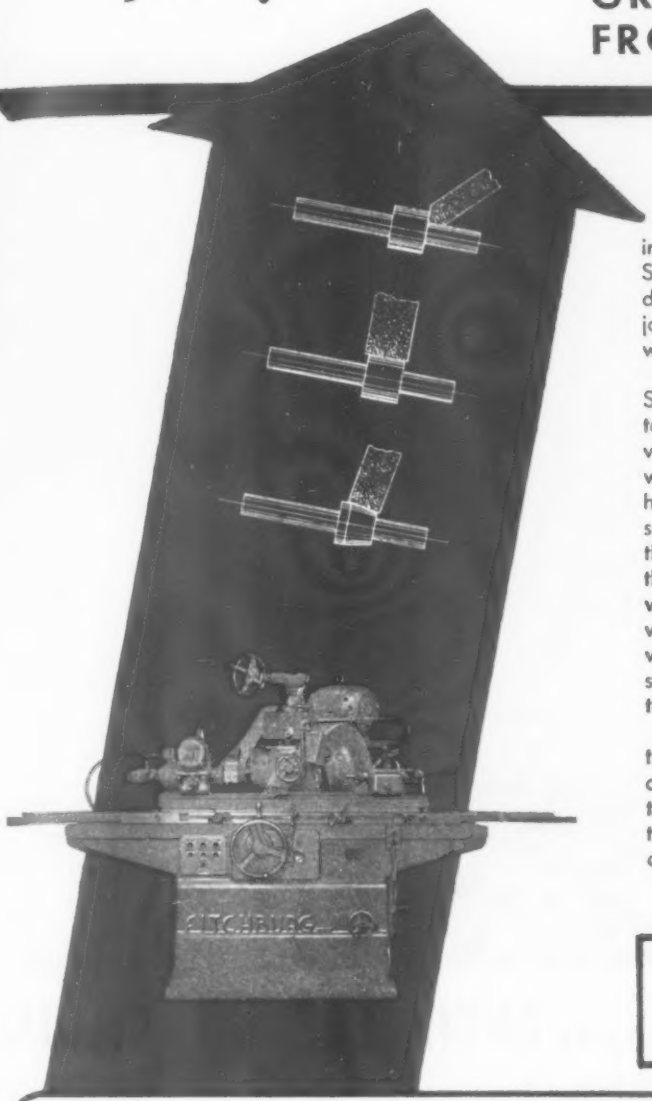
MONARCH LATHES

COVER THE TURNING FIELD

New FITCHBURG ADJUSTABLE "TYPE C"

Angular Head Grinder

FOR PLAIN CYLINDRICAL GRINDING . . . . . FROM *0 degrees to 45 degrees*



The Fitchburg Adjustable "Type C" Angular Head Grinding Machine is another single application of the Fitchburg Standard Bowgage Wheelhead Unit. The "Type C" is designed to handle a wide range, and a number of types of jobs. In finding ways to cut your grinding time and costs it will pay to consider what this machine can do.

This newest of Fitchburg plain cylindrical grinders has a Standard Wheelhead Unit mounted so that it may be located to grind from 0 degrees up to a 45-degree angle. Previously angular head grinding machines have been equipped with fixed heads for single purpose grinding. The Bowgage head on the Fitchburg "Type C" is adjustable and can be swivelled to various positions for standard plain grinding, thus providing greater grinding utility. The head goes through a completely automatic cycle — rapid traverse to work, correct feed, grinding dwell and rapid return. The workhead is adjustable for various lengths of work and the work spindle can be equipped for single or variable work speeds. The trueing device is hand operated and mounted on the work table.

The Fitchburg "Type C" grinder is designed to meet war time production speed and maintain highest efficiency. Ease of operation is assured by centralized controls. In every detail it meets all the requirements of plain cylindrical and taper grinding — in large or small lots of work, with assured accuracy and fine finish, at low cost.

Send for new fully illustrated folder — write for it on your business letter-head — it will be mailed free.

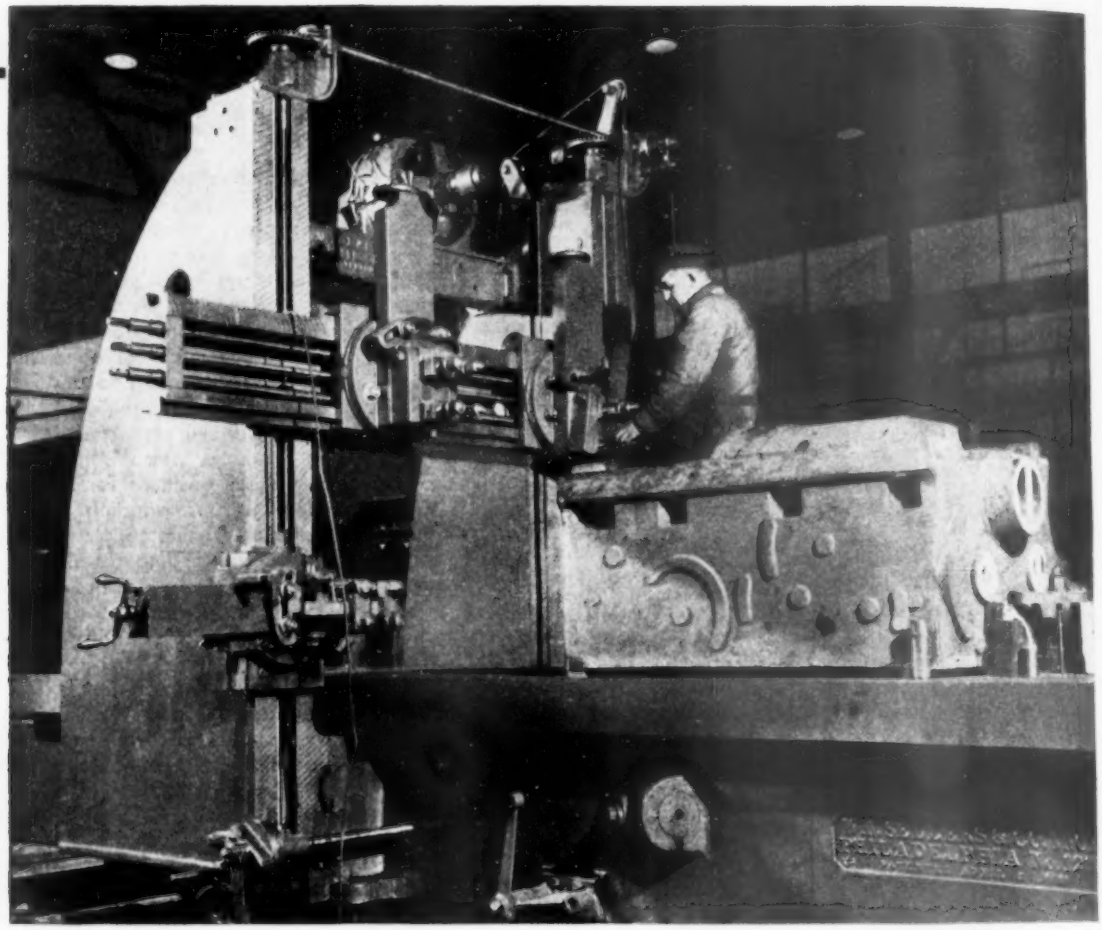
FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of — **Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.**

WEAPON No. 1

IN A WAR OF METAL*



* *Keep your machine tools in fighting trim by* ENGINEERED REBUILDING

Every piece of ordnance from the blueprint to the battlefield takes shape through machine tools. Not enough metal is available to build all of the machine tools required. *Therefore, industry must make the most of those it has.* This can be successfully achieved by keeping machine tools in fighting trim, by *Engineered Rebuilding* when they need repair. • Simmons has solved machine tool rebuilding and maintenance problems for leading armament plants. Learn how we can help you. Send today for a copy of "The Simmons Way." Simmons Machine Tool Corporation, 1810 N. Broadway, Albany, N. Y.

ARMY (E) NAVY

SIMMONS *Engineered* MACHINE TOOL REBUILDING

The tungsten, molybdenum, chromium and other elements that harden your high speed tools are more critical than steel. To insure their preservation, segregate tools from other steel scrap — keep tools of the same alloy type together. To insure a continued and plentiful supply of new high speed tools, get your old tools and dies to the scrap dealer or back to the mill just as soon as you have no further use for them.

NATIONAL

NATIONAL TWIST DRILL & TOOL DETROIT U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS

TWIST DRILL AND TOOL COMPANY

HOME OFFICE AND FACTORY—DETROIT, MICH.

Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

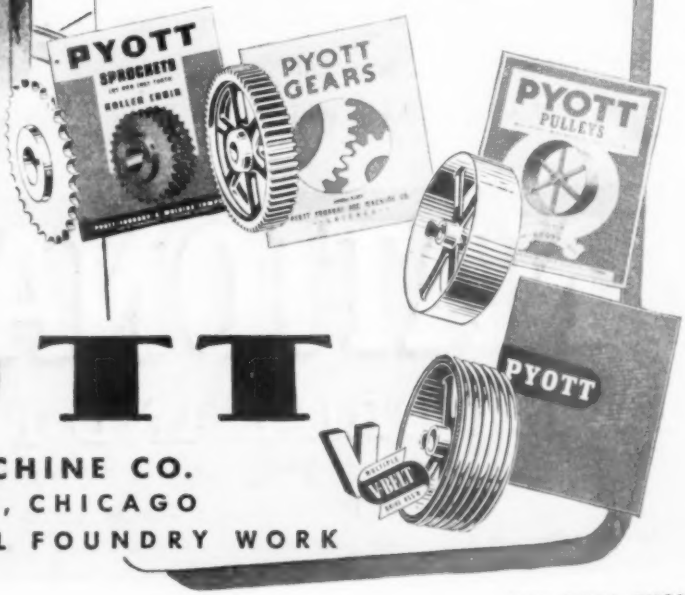
"YASSUH, MR. MORGAN, MY CUSTOMERS ALLUS COMES BACK"

FUNNY, isn't it, how most men go out of their way to patronize their favorite boot-black? It just goes to prove that *friendly* business relationships *are* important.

It's an old Pyott policy (established 46 years ago) to make friends out of customers by giving special attention to their specific needs and preferences—by extending ourselves beyond the skillful execution of their orders when the occasion requires it—by offering suggestions for lowering costs and expediting deliveries.

As a user of pulleys, gears, sheaves, sprockets and castings, you may not be enjoying the benefits of PYOTT Service unless you are a Pyott customer, which costs nothing extra. Why don't you give us a trial and learn for yourself by personal experience?

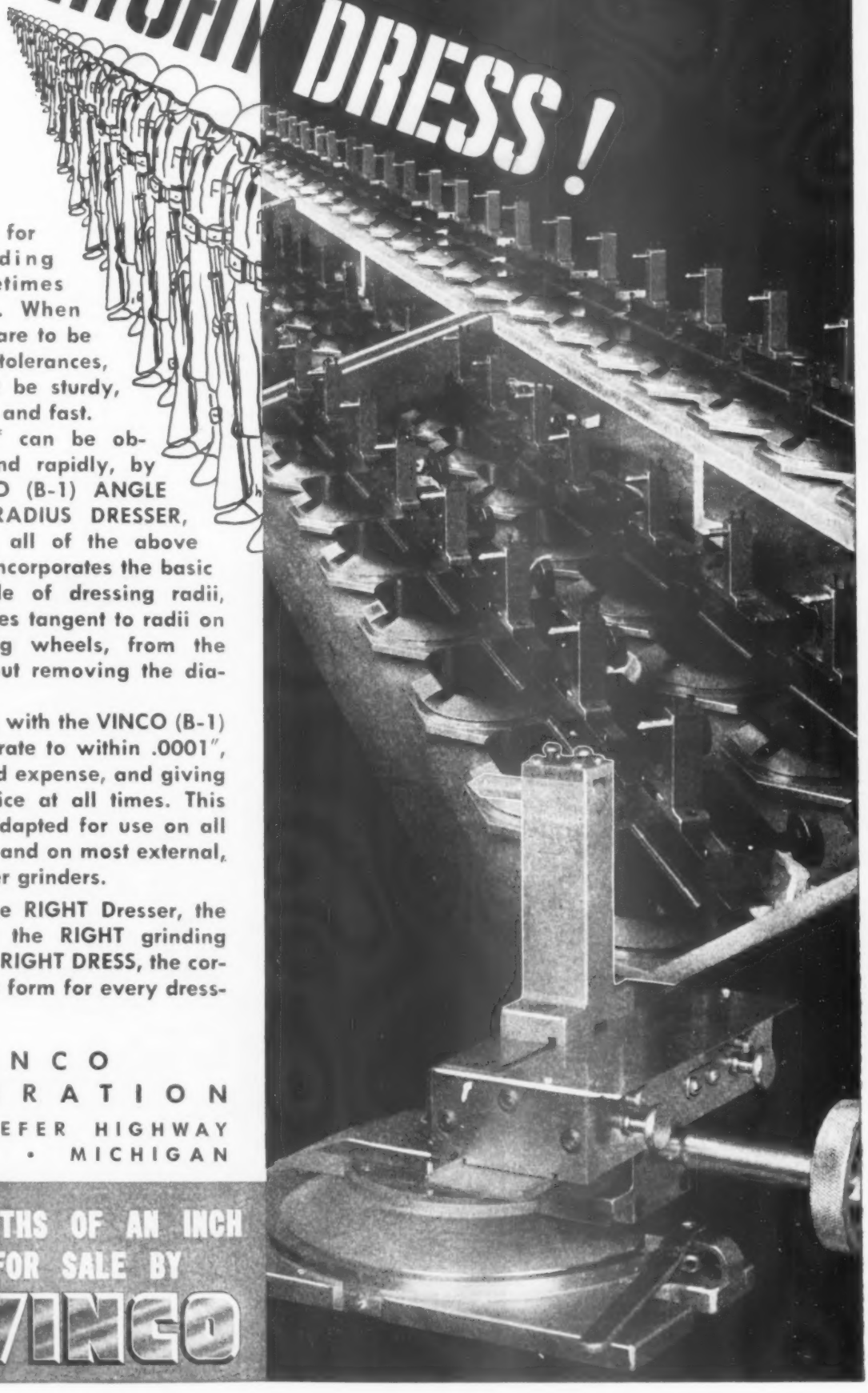
The four Pyott Catalogs give engineering information and prices on Sprockets, Gears, Pulleys, Sheaves and V-Belt Drives. Any or all are free for the asking. Please use company letterhead when requesting them.



PYOTT

FOUNDRY AND MACHINE CO.
328 N. SANGAMON ST., CHICAGO
CAST IRON AND SEMI-STEEL FOUNDRY WORK

RIGHT DRESS!



RIGHT DRESS* for abrasive grinding wheels is sometimes hard to obtain. When grinding wheels are to be dressed to close tolerances, the dresser must be sturdy, flexible, accurate and fast.

RIGHT DRESS* can be obtained, easily and rapidly, by using the VINCO (B-1) ANGLE TANGENT TO RADIUS DRESSER, which combines all of the above requirements. It incorporates the basic patented principle of dressing radii, angles, and angles tangent to radii on abrasive grinding wheels, from the same axis without removing the diamond.

RIGHT DRESS*, with the VINCO (B-1) DRESSER is accurate to within .0001", reducing time and expense, and giving trouble-free service at all times. This dresser can be adapted for use on all surface grinders, and on most external, internal and cutter grinders.

* Remember, the RIGHT Dresser, the RIGHT operator, the RIGHT grinding wheel, mean the RIGHT DRESS, the correct and accurate form for every dressing operation.

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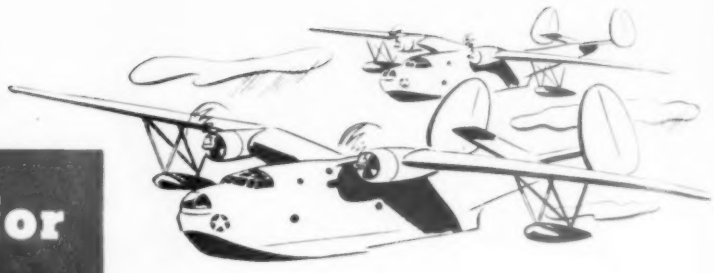

Saving minutes for Martin

The stamina that takes Martin aircraft all around the world—successful in battle on every front—dependable in transport operations—is built in at the Martin plants in thousands of precise details. Martin production knowledge takes advantage of every manufacturing short cut to save seconds and minutes and swell output.

One of these modern manufacturing operations is the precision straightening of struts and other parts. This work is more accurate and easier to handle on this Hannifin hydraulic press equipped with the exclusive sensitive pressure control. This control of ram pressures with a single hand lever or foot pedal is so simple and natural that operators consistently maintain high production rates on precision work. Finger-tip control is infinitely variable, delivering any ram pressure from a few pounds to full capacity, in proportion to the control lever movement.

Hannifin hydraulic presses are built in a wide range of standard types, capacities 5 tons to 200 tons, for straightening, assembly, forming, and similar work involving the application of pressure. Standard designs can be readily modified in table construction, gap, reach, and ram stroke, to meet individual needs. Write for press bulletins or consult Hannifin engineers for specific recommendations.

★

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HANNIFIN *Hydraulic* PRESSES

At a plant of The Glenn L. Martin Company: Hannifin 75-ton hydraulic press with long table, being used for straightening heavy struts. Ram stroke is adjustable, to avoid unnecessary up-travel in production operations.

PRODUCTION PERSPECTIVES*

LAST-MINUTE NEWS REVIEW OF MASS MANUFACTURING

*T.M. REG. U.S. PAT. OFF.

Production: Output of war materiel by metal cutting industries is still going up, shows no sign of leveling off as it inevitably must....December production was record-breaking due to year-end cleanup of assembly lines. January output declined, but production men came back in February to push the daily rate of manufacture 6 per cent higher than the December daily rate.

Breakdown: Application of mass production techniques is beginning to show in aircraft manufacture. February output rose 10 per cent above the previous month. Approximately 5,500 planes were produced, with an increase of 36 per cent over January in the output of heavy 4-engine bombers....Tank schedules have been adjusted downward, but other Ordnance is climbing steadily. Industry-Ordnance team hung up new records in February. Samples: H.E. shells, 1,932,000 rounds of all calibers, at a rate of 50 a minute night and day; 419,000 bombs of all sizes; 2,000 antiaircraft guns; 8,000 aircraft cannon; 1,244,000,000 rounds of small-arms ammunition at a rate of more than 500 cartridges a second for every second in the month....Ordnance production is now 300 per cent above a year ago. Some 10,000 prime contracts have been let, 70,000 sub-contracts have been let.

Machine Tools: The industry is now making substantial inroads on its backlog of orders and has cut the total between 8 and 10 per cent during the past month ....Early reports indicate the January production of 26,000 new machine tool units was equalled in the shorter month of February....Stories that several of the largest machine tool builders are taking on an increasing amount of sub-contracting have been found false by THE TOOL ENGINEER....Surveys on the use of machine tools indicate growing efficiency. While utilization never can be 100 per cent, it is expected to reach a practical maimum by the end of the year. This fact, admitted by the WPB, is interesting in light of its plan for machine tool transfer....Aircraft plants now nearing completion will make heavy demands on machine builders before the end of the year. The WPB says it will be necessary to "screen" all requests for new facilities directing new tools to critical programs only....If many machine tools are transferred, they will go to these new plants.

Big Planes: It takes longer to tool for 4-engine bombers than for fighters, and it takes longer to build them. These facts are significant in view of the sharp rise in big plane production last month. A reflection on the entire war production picture, it means that new facilities are coming into production, that much of the tooling job has been completed....Official admission that much-discussed Ford Willow Run production is not so bad is highly probable. The plant has now equaled its original planned capacity and will soon exceed it. Fly in the ointment is revised production demands by the Army without consideration of the original tooling program. But automen, faced with a terrific unskilled worker problem, swear output will continue to rise.

Materials: WPB says that knots in the Controlled Materials Plan are being ironed out, that CMP should be functioning smoothly by July 1. Detroit automen, who produce one-sixth of all American war goods, disagree. They are warning Washington that trouble is brewing unless WPB speeds the "ironing out"....India may offer U.S. considerable post war competition. American steel is being sent there at a regular quarterly rate, and manganese and molly will continue to be sent there in the hope that the country's steel output can be increased 50 per cent. India is the British Empire's largest producer of iron ore.

Tool Conservation BEGINS IN THE TOOL CRIB

Broaches (in circle, left) that formerly took much more space when spread lengthwise on flat shelves, now fit easily into these bins. Clear visibility and convenience to the delivery window mean less waiting time for these tools

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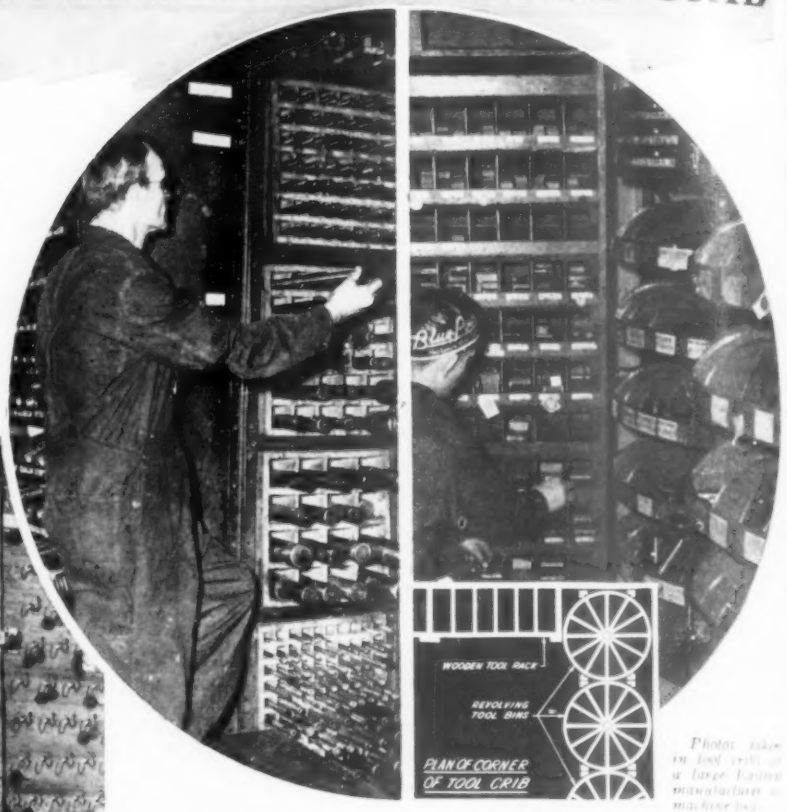
Revolving bins (in circle, right) make the most of every square foot of space, give ready access to their contents. Sketch indicates how former "dead corner" was saved, and space made for wooden tool racks.



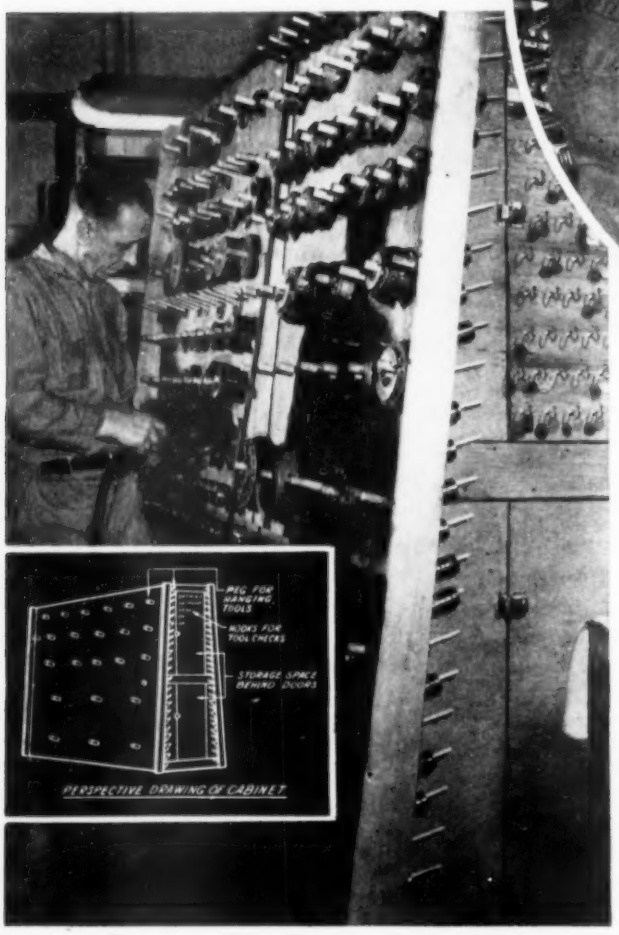


Photo courtesy of Arma Corporation, Brooklyn, N. Y.

Dead Space usually found in center of crib utilized by double deck "slanting-side" cabinet. Tools hang on sides, bulky items are stored inside. Doors are used for "in and out" tool checks.

AND Saves Space TOO!

Perhaps you've been thinking, "Yes, I'd like to plan my tool crib to take better care of my tools — but the plant can't give me more floor space."

Then you'll be interested in seeing how some plants improved their tool storage, and saved space too!

As these photographs show, space may be saved by:

1. Rearrangement of storage facilities.
2. Alteration or substitution of equipment.
3. Utilizing waste floor or wall space.

Yes, your tool crib can pay big rewards for a little careful thought.

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Mass Production Starts With DESIGN

A. E. RYLANDER

TECHNICAL EDITOR

•

Design does not necessarily imply drawings or layout; in a broader interpretation, it means planning to get maximum production from all machines and tools, be they simple or complex.

We may put the productive time of a tool as that interval when it is actually removing or shaping metal. The rest — as loading and clamping, unclamping and unloading, picking up workpieces and disposing them—is idle time as far as the tool is concerned. The less the idle time, the more the tool will produce per hour. All this is obvious and elementary, yet, in the writer's review of tool design and plant layout, altogether too little consideration is given to those factors that sway the balance in favor of productive time. In fact, it is the writer's belief that, by and large, the productive time of most tools could be considerably increased if not doubled through judicious consideration of such manual operations as handling and disposal.

We know, of course, that there are cases where the idle time cannot be practically cut, but that doesn't alter the fact that it exists. Take, for example, a large blanking or forming press running eight strokes per minute. The idle interval would approximate the active, but in that interval the operator or operators remove a punching and insert a blank. Even with the magazine feed and automatic ejection there is an interval of idle time; with such accessories, however, an operator might be running several machines, or tending one machine the speed of which precludes manual operation. Exceptions to the contrary, however, idle time can be reduced in most set-ups. And it all boils down to planning and designing for operator convenience.

•

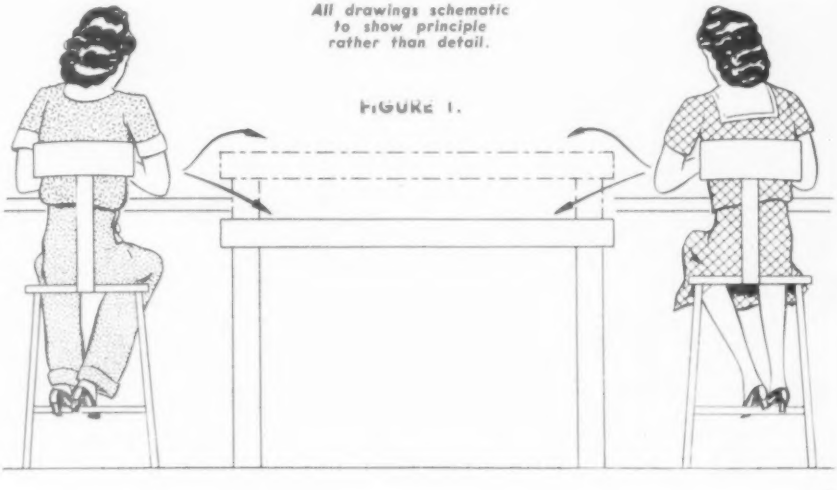
Consider the set-up shown in Figure 1. Two operators sit side by side, with an accumulation table between, performing a bench operation. As first set up, the table was high, (shown in broken lines), so that the operator at the right had to toss uphill, while the one at the left had to lift her arm to pick up a workpiece. The motions were awkward and unnatural, resulting in fatigue and irritation. Now, production was not doubled as a result of dropping the table level to convenient height, but there was an increase along with sweetened tempers and smoother motion.

Another set-up, involving cable stranders, is shown in Figure 2. Incidentally, these machines are used in textile, rope and electric cable production, broad fields for tool engineering in themselves. Up to a few years ago, it was the custom to run these machines in tandem or gang-in-line to lay alternate reverse strands—*i.e.*, the core would be wound righthand, the next lamination left-hand, and so on. The layout meant that an operator would have to walk from unit to unit to repair breaks — say anywhere from 15 to as many as 60 feet or more.

Then, by happy inspiration, the machines were decked, as shown in Figure 3; by that simple change the maximum walking distance was reduced to the length of one unit. Coincidentally, valuable floor space was gained since several units were now disposed of in the space formerly occupied by one. Obviously, productive time was considerably increased while operator fatigue was reduced.

While on the subject of cable manufacture, one operation consists of taping wire and cable prior to tubing — *i.e.*, rubber coating. The tape — usually friction tape of various widths — is laid on with a flyer provided with a tension brake. It was the custom to put one roll at a time into the flyer, then, when that ran out, to stop the machine, remove the cover plate, pick up a fresh roll, thread it and patch. Again a happy thought! The flyer was made wide enough to take several rolls, and while it still meant stopping the machine to patch the break, it obviated removing the cover plate and picking up a fresh roll for each stop. It worked so well that, as a natural afterthought (why can't we think of everything at once?) a second flyer was installed in place of the counterweight formerly provided. Again, no doubled time, but a considerable increase in production. The improved design is shown in Figure 4, in which the original is shown in solid lines, the stages of change in broken lines.

One other and more radical innovation was effected under the writer's observation. Heavy stranding, as the twisting of large cables to form overall diameters of two inches and over, had formerly been done with horizontal machines. That required large flyers, as the cable reels might be 30 inches or more diameter and heavy in proportion; also, it entailed spiders for the disposition of jute with which to fill the interstices. The whole took up considerable floor space, required several operators and entailed an inordinate amount of walking. So, a vertical machine was



All drawings schematic to show principle rather than detail.

FIGURE 1.

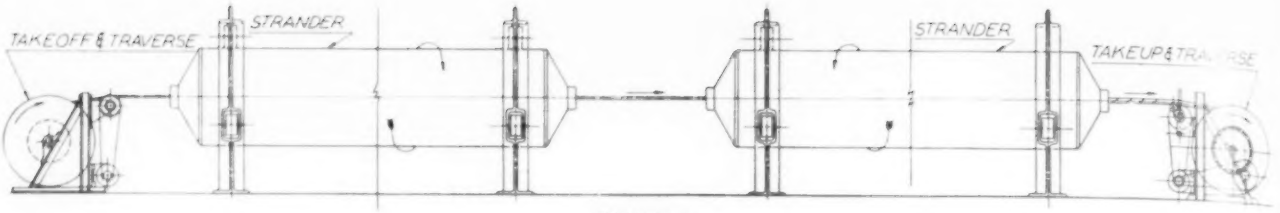


FIGURE 2.

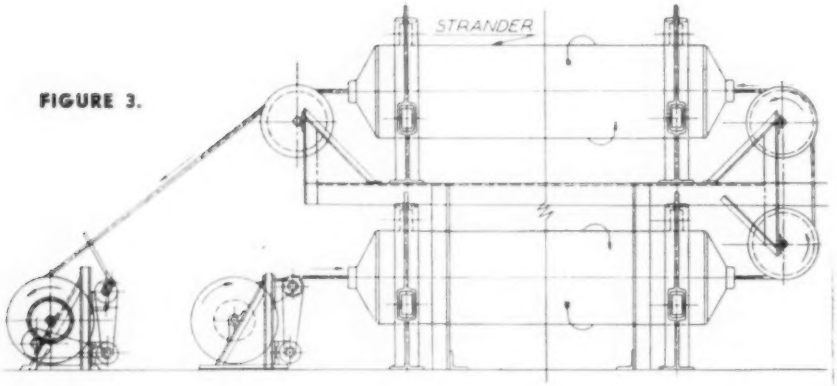


FIGURE 3.

designed as shown in Figure 5, with the operator working on a platform, the strands converging at convenient height and the finished cable looped over an overhead pull-out sheave. From there, its descent to the take-up on the floor below provided both time and safety for inspection. The flyer, running in a vertical plane, was enclosed by a guard rail, with the jute spiders disposed between the tie rods. The whole took up comparatively little space, using height in lieu of length. And, while it did not

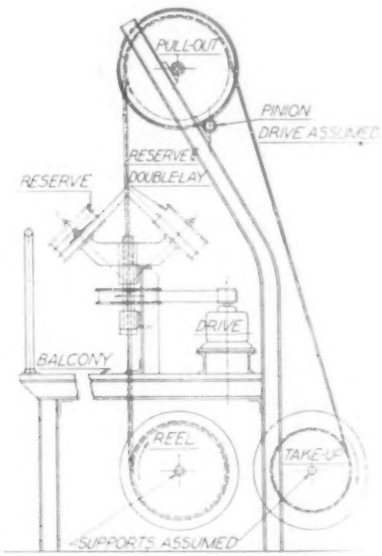


FIGURE 4.

radically boost production (there was enough increase to pay for the machine in a year or so), there was the saving through requiring but one operator, as well as plant space gained.

Coming back to more familiar ground for most of us, consider the purposely nondescript workpiece shown in Figure 6. There are several holes symmetrically disposed; two drilled, two tapped through and one stepped, tapped one side of the slot and drilled to comparatively close tolerances on the near side of view. By conventional practise, it was machined in a gang drill, one spindle provided with a multi-head for drilling

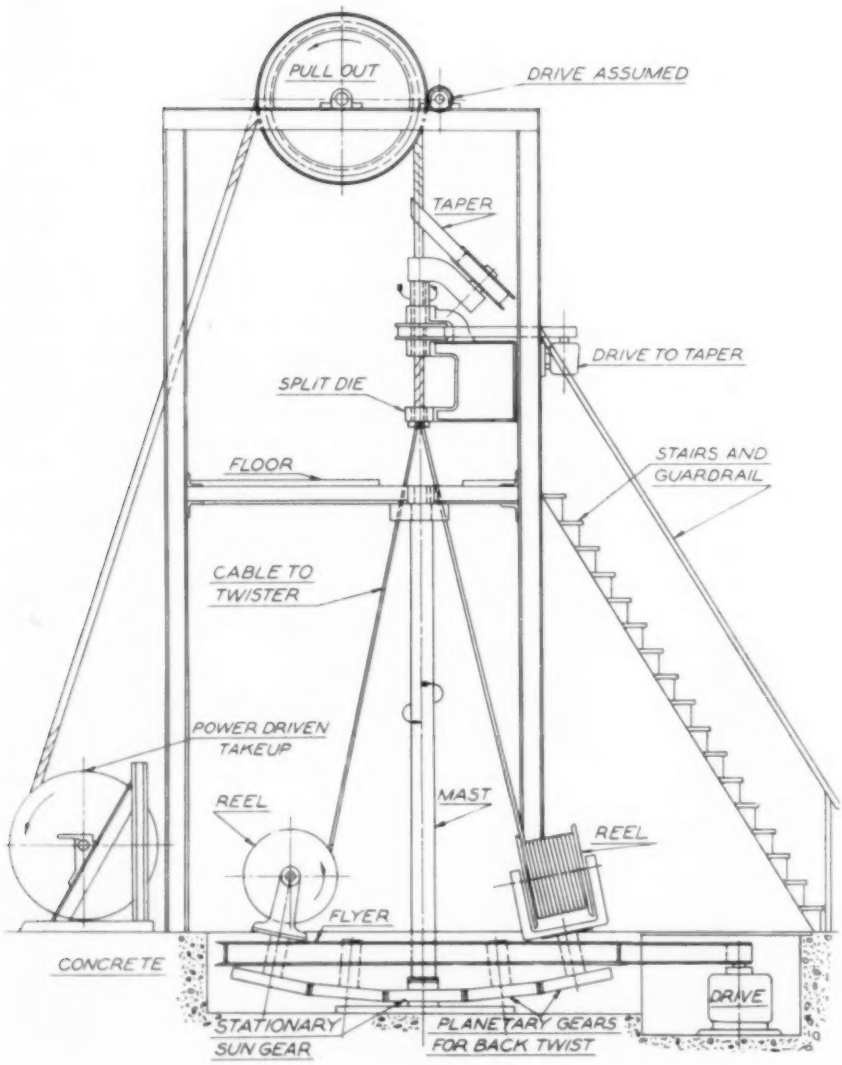


FIGURE 5.

all holes — *i.e.*, tap and clearance — another for counterboring the stepped hole and the third to tap one hole at a time. The length of the thread was so short that a two-spindle head would have been only a superfluous gesture. An orthodox fixture was used, with one clamp, manually operated.

Now, obviously, considerable time was lost in picking up and disposing the work, in clamping and unloading, in passing from spindle to spindle, and so on. The problem was resolved as shown in Figure 7. Here, the layout is largely schematic, since detail would only result in confusion of lines. Anyway, it is hoped that verbal description will be clear enough to supplement the drawing. In the improved layout, the part was machined in a horizontal drilling machine, spindle fed by means of a spider and rack provided with rack and pinion, catch pawls and kick-offs. The right-

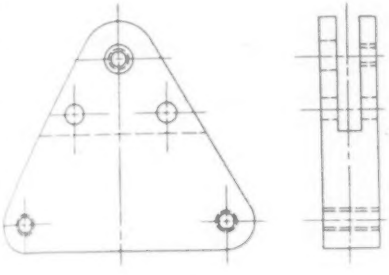


FIGURE 6.

hand multi-head drills, the left-hand taps, to use present tense for convenience.

The workpiece is dropped loosely into a stationary fixture, with the clamping effected by receding spring plungers in the bushing plate. That is, the bushing plate is its own clamp, somewhat after the manner of conventional pump jigs, wedging the workpiece the tighter as the spindles advance. As soon as the drilling is completed, the tapping head advances with the recession of the drill head; hence, the tapping is done with one motion. The tapping head comes to a stop, when the receding drill head kicks off, meanwhile having preloaded a spring which, on release, reverses the tapping head, which then backs off. Just like that! — simply told and not so complicated in execution.

One point may puzzle the reader: — the matter of tap and clearance drilling the stepped hole simultaneously. Duck soup! A combination center drill, slightly modified, pro-

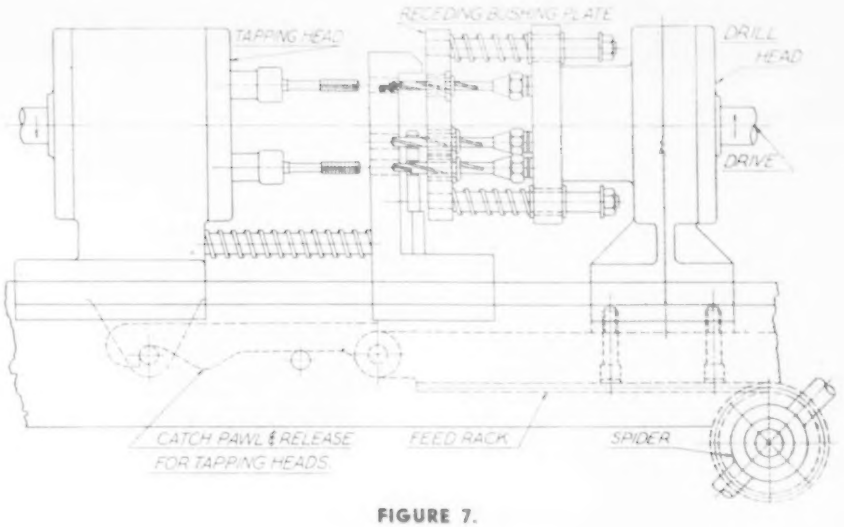


FIGURE 7.

vided the tap drill, the larger diameter then acting as a reamer. As an added explanatory note, guide pins should be provided between fixture and drill head, but hardly necessary for the tapping head, since the taps float anyway.

A method of handling (feeding and disposing) is shown in Figure 8. The idea is extremely simple and, with modifications, can be applied to a great many products. The workpiece is manually fed into the chute and manually disposed during the interval of cut. In the entire set-up, there are practically no more units involved than in the conventional layout that preceded the improvement; they're just as different and differently disposed. Yet, the idle time is reduced to a minimum, the operator stands or sits comfortably and without tiring movements, the whole resulting in a 50 percent increase in production without extra labor cost.

There are innumerable instances where workpieces may be hopper fed to the tool. And, with the combination of simple air or hydraulic motors (cylinders) comparatively simple, standard machines may be made practically semi-automatic. As a matter of fact, there is little excuse, these days, for slow operations when we have so many commercial accessories for the expedition of manufacture. Solenoids and adjustable, hypersensitive switches and relays impart instantaneous response to impulses, act as boosters or exciters to otherwise slower moving units. In this connection, however, the writer has yet to see a solenoid ideally suited to the tool engineer's requirements. Something will have to be done to improve them, but that is an item for future consideration.

THE END.

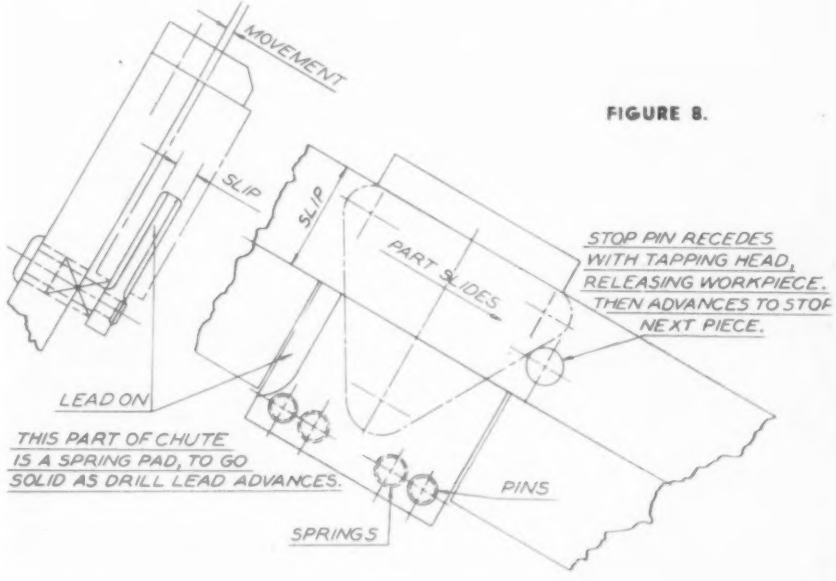

MOVEMENT
SLIP
SLIP
PART SLIDES
STOP PIN RECEDES WITH TAPPING HEAD, RELEASING WORKPIECE. THEN ADVANCES TO STOP NEXT PIECE.
LEAD ON
THIS PART OF CHUTE IS A SPRING PAD, TO GO SOLID AS DRILL LEAD ADVANCES.
PINS
SPRINGS

FIGURE 8.

X-RAY AIDS INDUSTRY

WILSON SMITH

X-RAY TECHNICIAN
MIDLAND STEEL PRODUCTS COMPANY

THE USE OF X RAYS in the non-destructive examination of opaque materials, parts and assemblies is growing rapidly. For inspection of welds, castings and even riveting the method is fast and dependable.

Some of the types of welding applications that are and should be X-ray examined are listed below:

(1) Boilers—which are subjected to high pressures.
(2) Checking of welding techniques—X-ray will frequently tell if technique is practicable.
(3) Structural defects—such as welding on tanks, guns, and bridges.
(4) Machined welding: if expensive machining is to be done it is frequently important to know if the specimen is defect free.

The defects that are frequently found in welding show the following general characteristics:

1. Cracks: dark lines.
2. Gas or blow holes: tear drop or hollow-like dark areas.
3. Porosity or excessive gas: salt and pepper distribution of small, rounded, darkened areas.
4. Slag: sharp and distinct, dark foreign appearing inclusions.
5. Lack of fusion: space between parent metal and weld bead.
6. Poor penetration: frequently appears as double line.

Figure 1 shows radiographs of defective welds, as well as a sound weld. Characteristics are readily visible.

The defects that can be found in castings are readily describable, such as blow holes, inclusions, and shrinks. Figures 2a, 2b and 2c illustrate the value of X-ray examination of castings.

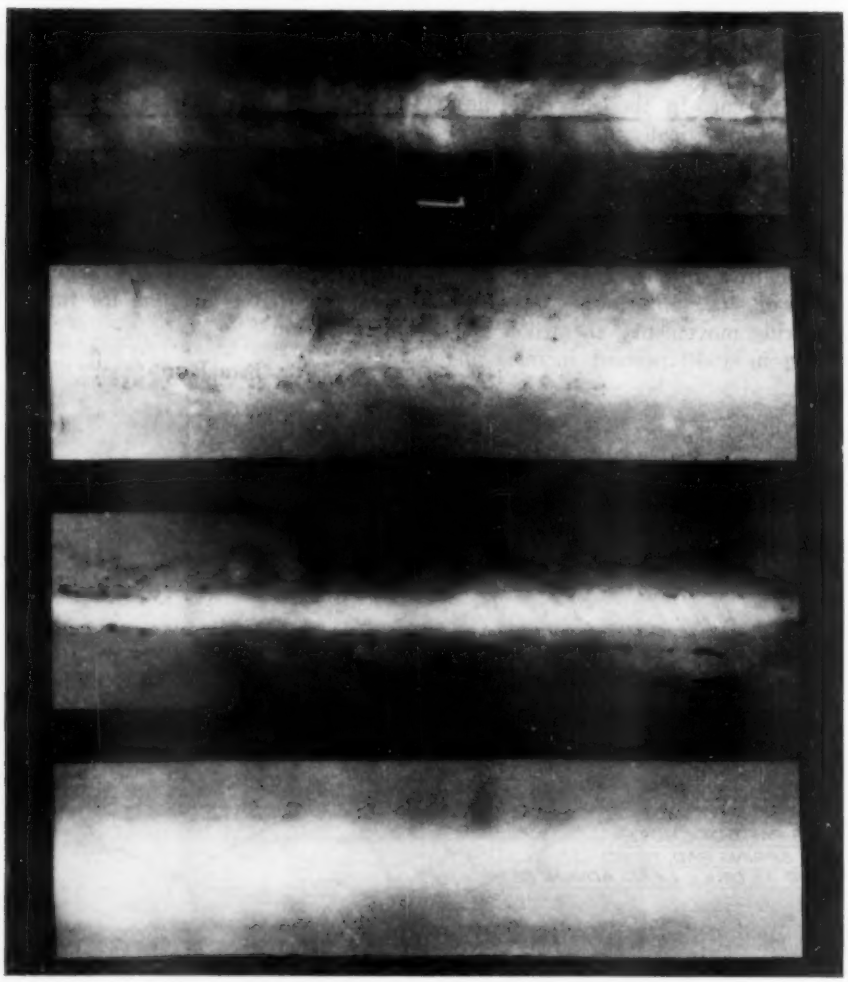
A large mid-western foundry, engaged in the war effort made some rectangular shaped steel castings weighing about 100 pounds apiece and developed trouble in machining. Large blow holes threatened structural soundness. The company had manufactured about 500 before any had been radiographed. Of 250 submitted for radiograph, 80 percent were found to have blow holes of such a nature that they were rejected. The remaining 250 were radiographed and of the total of 500, 270 had been rejected, 60 had been border lines and had to be repaired and only 170 were acceptable.

The trouble resolved itself into a simple problem in gating, and had it been discovered earlier by radiographing, it could have saved the company a considerable sum. After correction of gates, two percent radiographic control of the first 500 and one percent control of the balance of 2000 castings showed the flaws completely eliminated.

X-ray is used both as a laboratory instrument to control production and for production inspection where cost is more per exposure than the article being examined, it is largely used in the laboratory. The situation in its last analysis is an individual one. Whether to X-ray or not depends on careful study of all problems.

Most authorities agree that a number of conditions (some of them mentioned above) should not exist in certain types of work and, up to the present time, X-ray is probably the best way of detecting them.

General Electric X-Ray Corporation photos and radiographs



WHAT ARE X RAYS?

X rays are a form of radiant energy, in many respects similar to visible light. They travel at the same speed and obey many of the same laws. Their wave length is much shorter and it is this peculiar property which allows them to penetrate materials which would absorb or reflect longer waves. The wave length of X Rays is about

FIGURE 1.

At top is a radiograph of a weld having considerable porosity and lack of fusion. Next down shows weld containing great porosity. Below that, slag inclusions, undercutting of the parent metal and some porosity are indicated. Bottom is a good, sound weld.

Practical application of X-ray to inspection of castings and welds may be furthered by knowledge of how it is used, what equipment is needed.

1/10,000 that of visible light.

How are these rays formed? Of various explanations, the newer and accepted Planck's "Quantom Theory" holds that X rays are the result of electrons flying back to their rightful place in their atomic structure from whence they have been knocked by a rapid, high voltage electric stream.

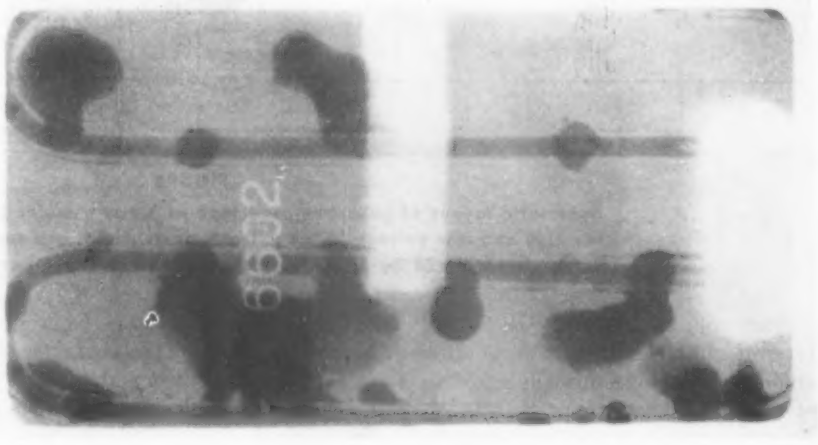
These electrons that are replaced need not be the same ones that are knocked out; they may be from another ring or from the electronic stream itself. The atom, like humans, strives for self preservation and will strive to remain in its natural state. The electrons, which go through the atomic structure and strike no electrons at all, generate heat, a phenomenon that occurs 99 per cent of the time, thus for every one percent of X ray emitted there is 99 percent heat.

FIGURE 2a.

FIGURE 2b.

Figure 2a. a cast steel melting pot containing electric heating elements in the bottom. Figure 2b shows a cross-section of the pot, which verified radiographic findings, but failed to indicate the extent of porosity. Figure 2c, the radiograph, shows the porosity and lack of continuity in parent metal. No indications of any sort appeared in surface examination as shown in Figure 2a.

FIGURE 2c.



THE X-RAY TUBE

To understand the use of X rays industrially the following description of the components of a system may be helpful. Figure 3 is a schematic layout of a general type of circuit.

Basically, the X-ray tube, source of X rays, consists of two parts, the cathode or negative and the anode or positive part enclosed in a suitably shaped glass envelope from which air has been exhausted. The cathode is the source of electrons. It consists of a spiral filament of tungsten wire heated by about four amperes at 12 VT. from a step-down transformer. Surrounding the filament is a focusing cup which serves to direct the electrons to a small area on the anode. When this filament is energized and becomes incandescent it liberates small glowing particles which act as a bridge in guiding the hi-speed electronic stream across the intervening space to the anode or positive part of the tube.

The anode is usually a solid piece of copper with its face cut to an angle of about 30 degrees. Set in this face is a small block of tungsten which is the target or the place to where the electron was directed. Tungsten is used because of its high melting point while the copper stem tends to conduct and dissipate the heat rapidly.

A radiator is usually used, either a fine type which allows air to circulate and cool it or sometimes an arrangement is made where water or oil is the cooling agent.

GENERATING APPARATUS

For the production of X rays it is essential to have directional, hi-voltage current.

Current brought in on 220 V AC lines, enters an auto transformer which consists of a soft iron core, wire wrapped which has been tapped so all or part of it may be used to deliver varying voltages. Its purpose is twofold. It serves as the control over the amount of current supplied to the transformer and supplies filament current to the X ray tube necessary to the incandescence of the tube filament.

To convert high voltage, alternating current to directional current, a number of devices are in use which are called rectifiers.

Two of the most commonly used in industrial radiograph are:

1. The voltage suppressor type rectifier. This type of suppressor (or valve tube) which is similar to a radio tube or X-ray tube is inserted in one side of the primary circuit. As electrons will only flow from the cathode to the anode direction, on the electronic alternatives indicated by the arrow, the suppressor tube will admit the flow and complete the circuit. On the opposite alternation the suppressor tube will not admit the flow, the circuit is incomplete and in effect you have directional electronic flow. A resister is shunted across the suppressor tube to allow just enough inverse current to flow across so the magnetic field is collapsed in readiness for the next alternation.

2. The voltage doubling type rectifier.

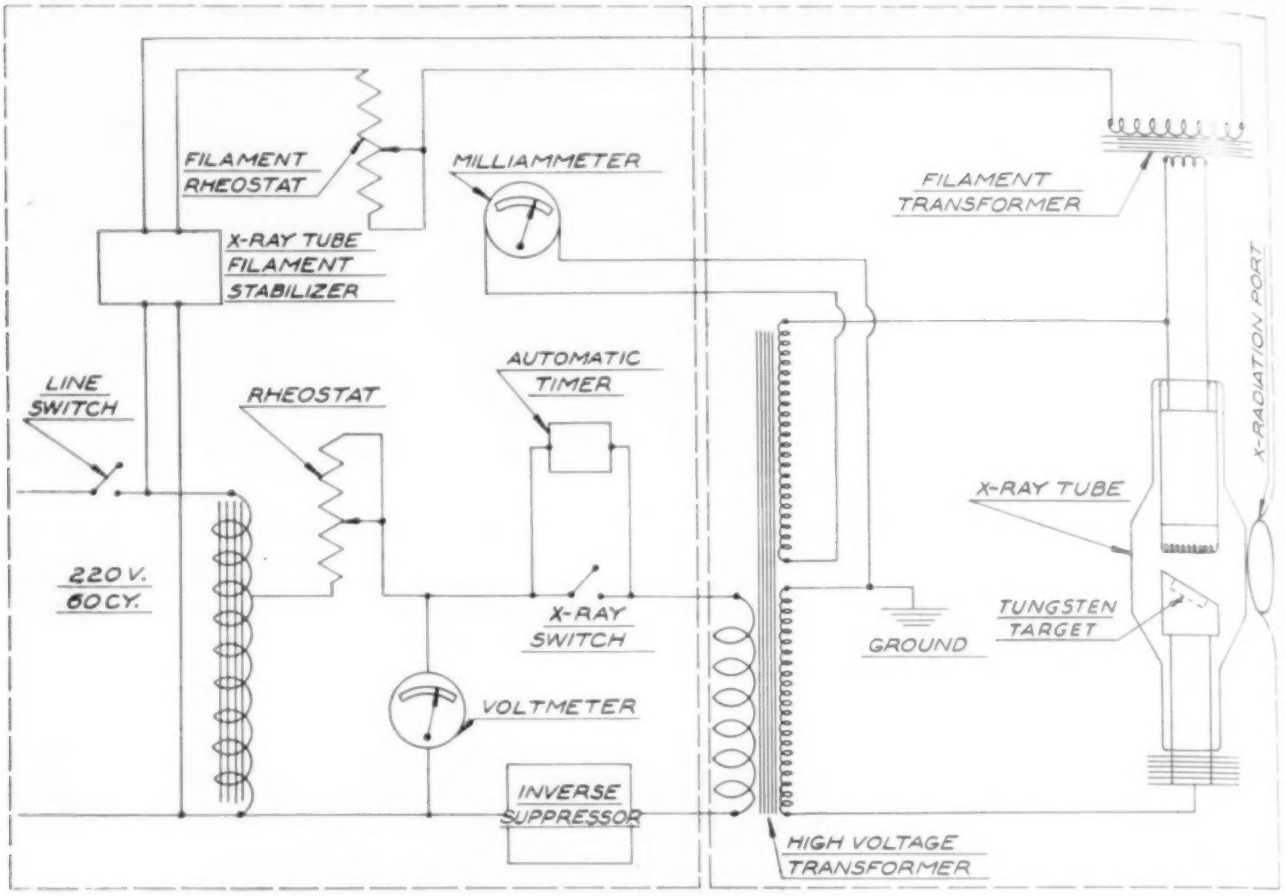


FIGURE 3.

Schematic layout of generally used type of X-ray machine circuit. Dotted lines divide high and low voltage. High voltage parts, right, are sealed in oil immersed container (approx. 20 by 30 by 40 inches). Low voltage parts are on control panel.

The voltage doubling or Villard type of circuit, as its name implies, doubles the voltage through a system of condensers and suppressor tubes. As the system is somewhat complex, arrows show only the electronic flow.

On the alternation (indicated by the arrow) the electrons pass through both valve tubes and condensers not entering X-ray tube, leaving a charge in each of the condensers. When the alternate cycle takes place, the charges in the condensers, plus the original voltage, are carried through the circuit (not through valve tubes) and a double voltage is delivered.

PROTECTIVE MEASURES

The hazards that the use of X rays present are considerable. Any or all of the body tissues may be damaged by exposure to them—the skin, blood and some of the internal organs being most readily affected. Operators and spectators must not only be cautioned against primary radiation, but against the secondary rays which are frequently forgotten or disregarded. When the rays bounce off the original object, secondary or characteristic radiation is liberated and these rays are only slightly less dangerous than the original.

If the technician must watch the operation there should be sufficient lead glass between himself and the rays as a shield.

It is also well to carry a small piece of film upon which a solid object (such as a paper clip) has been fastened. This is carried for about two weeks, then developed. If the image of the solid object is upon the film, the protective precaution should be increased. Radiographers should also be given periodical blood tests so that the necessity for additional safeguard will be noted in adequate time to prevent damage from X-ray exposure.

The high voltage used to generate X rays also demands reasonable precautions. In modern installations shock-proofing and oil immersed apparatus, have lessened danger appreciably, but the operator should periodically examine his equipment.

SCREENS

When X rays strike a film only about one percent of the radiant energy is absorbed by the film, the other 99 percent fails to perform any work, unless some method is used to convert it to useful form. Screens are the logical answer.

Certain chemicals, such as calcium tungstate, have the power to absorb X rays and emit a blue or green light —i.e. fluoresce. This compound is finely powdered, mixed with a suitable binder and mounted on cardboard, and is frequently used to intensify the action of X rays upon the film.

In industrial X ray, lead foil screens play an important part. It has been discovered that in voltages of around 200,000 lead tends to fluoresce similarly to calcium tungstate and as the lead also serves to absorb the undesired secondary radiation, films of maximum clarity and detail are obtained. The voltage at which lead has these properties obviously makes it more practicable on high voltage radiography. THE END

Pilots for Progressive Dies

STANLEY R. COPE

PRESIDENT

ACME SCHOOL OF DIE DESIGN ENGINEERING

Pilots are used in progressive dies to hold the proper relationship between the pierced holes and the blank. Since these operations are done in separate stations of the die, provision must be made to locate the strip accurately between stations.

The simplest application of pilots is that used in ordinary 2-station progressive piercing and blanking dies. The pilots are fastened in the blanking punch. After the first set of holes is pierced (first station) the strip is advanced to a position under the blanking punch so the previously pierced holes are almost directly under the pilots. In the second stroke of the press (second station) the pilots, advancing ahead of the blanking punch, fit snugly into the holes and accurately align their position with that of the blanking die allowing it to produce the piece (Figure 1).

When progressive dies have more than two stations other pilots must be placed in the station next to that which pierces the first holes. To use a shop expression, holes must be immediately "picked up" (piloted) after they have been pierced. A common designing error provides for piercing a group of holes and then skipping a station before providing pilots. Such dies invariably have to be redesigned.

Direct Piloting: When pilots are used in holes in the blank itself, the application is known as direct piloting. For several reasons direct piloting is not always possible or practical. Chief among these is the case where the blank has no holes. Other reasons forbidding the use of direct pilots are: holes are too small, too close together, too near the edge of the blank, or too accurate to chance injuring them. If stock is too thin it may prevent use of pilots. Set rules for all cases cannot be made; but Figure 2 shows general obstacles to direct piloting.

Indirect Piloting: When piloting is desired, but the direct method is found impossible, indirect piloting is employed. With this system extra holes are pierced in the waste portion of the strip in one station for use in succeeding stations.

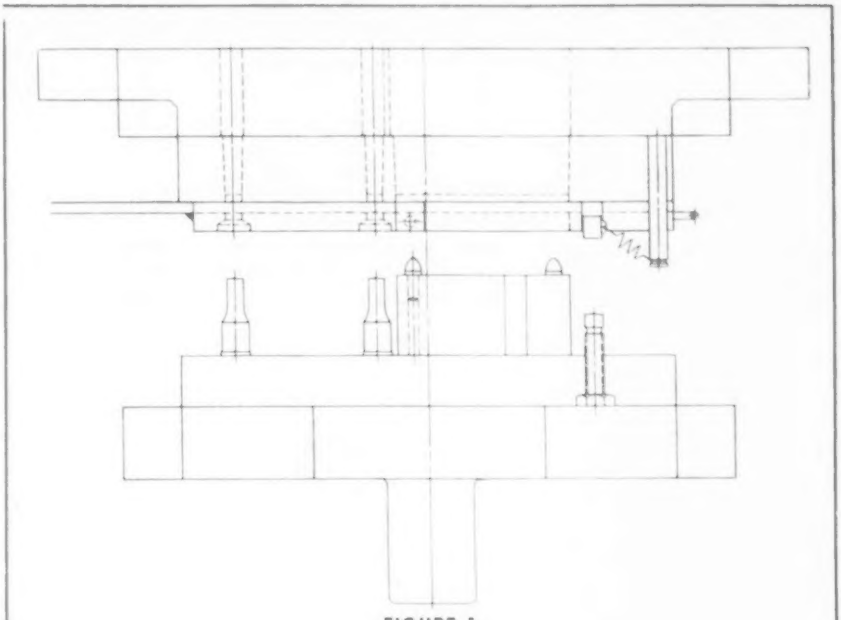


FIGURE 1.

Pilots are of two general types: solid and spring. Solid pilots are built solidly in the die. In the event they miss the holes (as often happens) they either bend down the stock or pierce new holes. Spring pilots have a spring back of them. If the pilot misses the hole the spring is compressed and the pilot recedes without damaging the strip.

Solid pilots are always used when they are located in the blanking punch. They are also used in piloting other parts of the strip if the stock being used does not exceed 1/16-inch in thickness. Up to this thickness solid pilots will pierce holes almost as cleanly as piercing punches in case of a misfeed. For piloting in greater thicknesses outside of blanking punches, spring-backed pilots should be used.

Pilots that serve in nearly all cases are shown in Figure 3. In the top row are shown (types 1, 2, 3 and 4) the types of pilots which are placed directly in the blanking punch. The squares which contain the pilots represent the blanking punch and the rectangular sections above them the punch holders.

- **Type 1**, a straight pilot, is used for holes under ¼-inch diameter. It is backed by a set screw which provides for adjustment after the punch has been ground, and permits quick replacement in event of breakage.
- **Type 2**, the common shoulder pilot, is recommended for holes ¼-inch to ¾-inch diameter. Standard proportions of shoulder pilots are given in the tables which also accompany this text.
- **Type 3**, the threaded shank pilot, is preferred for use on high-speed dies or where there is a danger of the pilot falling out without being noticed. Thousands of blanks each year are spoiled because pilots fall out or break off and remain unnoticed.
- **Type 4**, the screw type, is used for piloting in holes over ¾-inch diameter. Pilots with large shanks are difficult to hold in place by simple press fitting.
- **Type 5**, a solid pilot, is used as a direct or indirect pilot outside the blanking stage. It is made from drill rod and is hardened and polished. A small hardened plate is provided to

Improper design and use of pilots wastes time and money in redesigning dies. Facts on proper application are presented in this article—save for the "know-how" file.

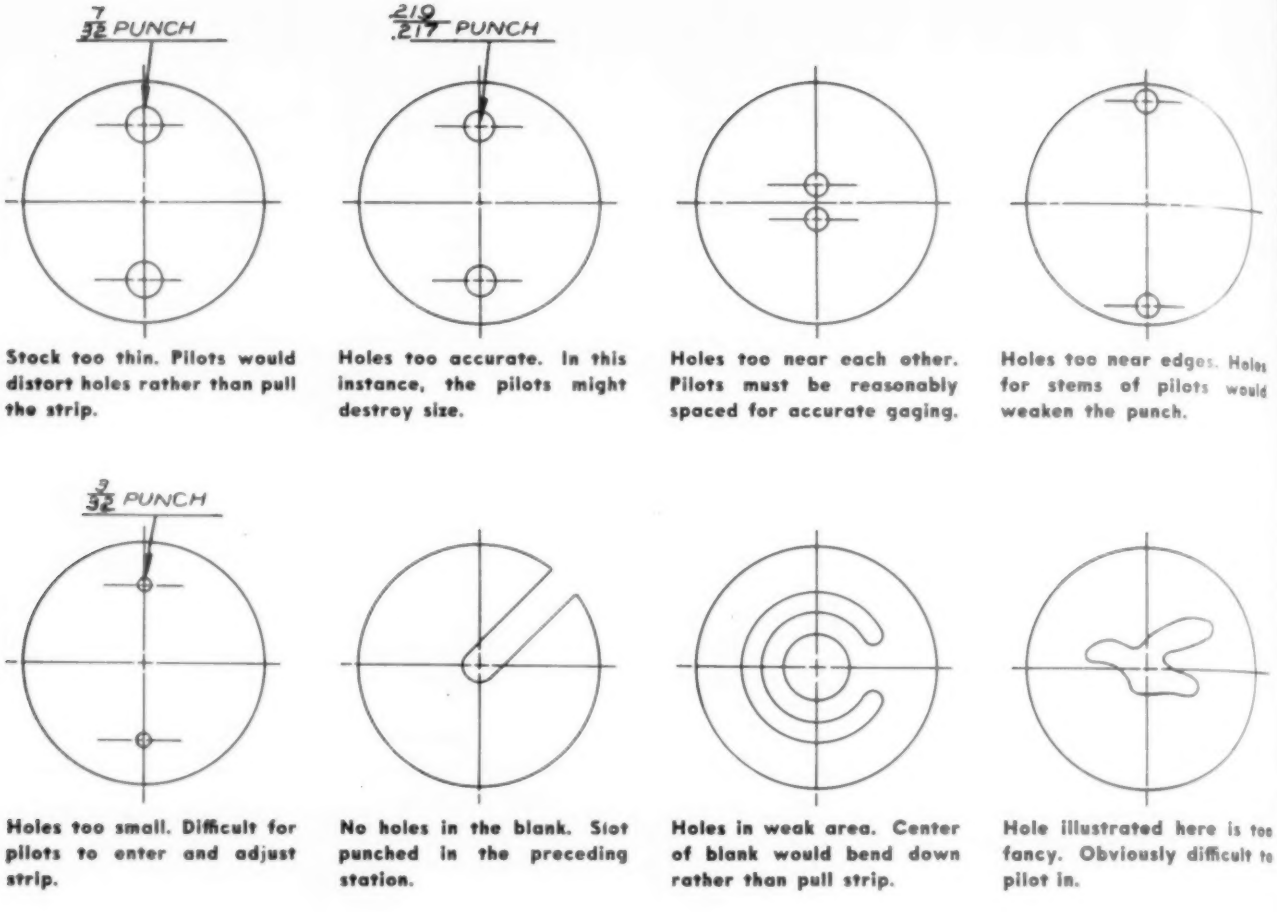

7/32 PUNCH
.219/.217 PUNCH
Stock too thin. Pilots would distort holes rather than pull the strip.
Holes too accurate. In this instance, the pilots might destroy size.
Holes too near each other. Pilots must be reasonably spaced for accurate gaging.
Holes too near edges. Holes for stems of pilots would weaken the punch.
9/32 PUNCH
Holes too small. Difficult for pilots to enter and adjust strip.
No holes in the blank. Slot punched in the preceding station.
Holes in weak area. Center of blank would bend down rather than pull strip.
Hole illustrated here is too fancy. Obviously difficult to pilot in.

FIGURE 2. REASONS FOR INDIRECT PILOTING.

prevent it from becoming imbedded in the punch holder. Pin pilots (such as this type) must be guided in a hardened bushing in the stripper. They should not be used where space permits the use of the headed pilots (shown in type 6).

• **Type 6**, a headed pilot, serves the same purpose as type 5, but is not as subject to bending or breaking. Headed pilots are made of tool steel, hardened and ground.

• **Type 7**, a quill pilot, illustrates a third method of constructing a pilot. It consists of a piece of hardened drill rod of correct diameter pressed lightly in a machine steel quill (holder) and backed up by a standard hardened set screw. It is recommended for use in holes under 3/16-inch diameter. Quill type pilots are very strong because they are well supported and are free from steps or shoulders which often cause a pilot to become brittle after it is hardened. They can be replaced more quickly than other pilots in case of breakage. Pin pilots under 3/16-inch diameters are apt to become bent quickly. Headed pilots snap off readily. These troubles become more prevalent when piloting in metal of heavier gage.

• **Type 8** pilot is a form used with blanking punches which are not round. It is similar to type 4. A dowel pin is provided to prevent the pilot from turning out of proper position. Some designers mill a hole in the punch of the same shape as the pilot and fit a straight pilot into it. Then a dowel pin is not required. But this method is more expensive than that shown in type 8. The liberal space under the shoulders of types 4 and 8 is provided to permit room for the shanks when the punches are shortened by sharpening. The tapped holes in the shanks should be deeper than those ordinarily used. This will permit using the original screws after the punches are reduced in height by sharpening.

• **Type 9**, a spring-backed pilot is used in piloting stock over 1/16-inch thick and where space for the pilot is limited. The pilot is of a simple straight design with a head. It is guided at the top in a bushing which is pressed into the punch plate. Another bushing pressed into the stripper guides it at the bottom. The sectional view at the left shows the pilot as it normally appears during the operation. At the right it is shown in the position it takes if the strip is misfed.

• **Type 10**, is a more substantial pilot than type 9. Where space permits this type should be used.

• **Type 11**, a quill type spring pilot, should be used for piloting in holes under 3/16-inch diameter. The quill must be made of tool steel, hardened and ground to resist the wear caused by its up-and-down travel in the bushing when the strip is misfed.

IN LAYING OUT spring pilots designers often make a serious mistake in attempting to specify the proper spring. The spring tension back of the pilot must be great enough to allow the pilot to "pull the strip along" during the normal operation of the die without permitting the pilot to rise. It must not be too strong or it may pierce a hole in case of misfeed.

Because of the many factors involved in the use of spring pilots, such as

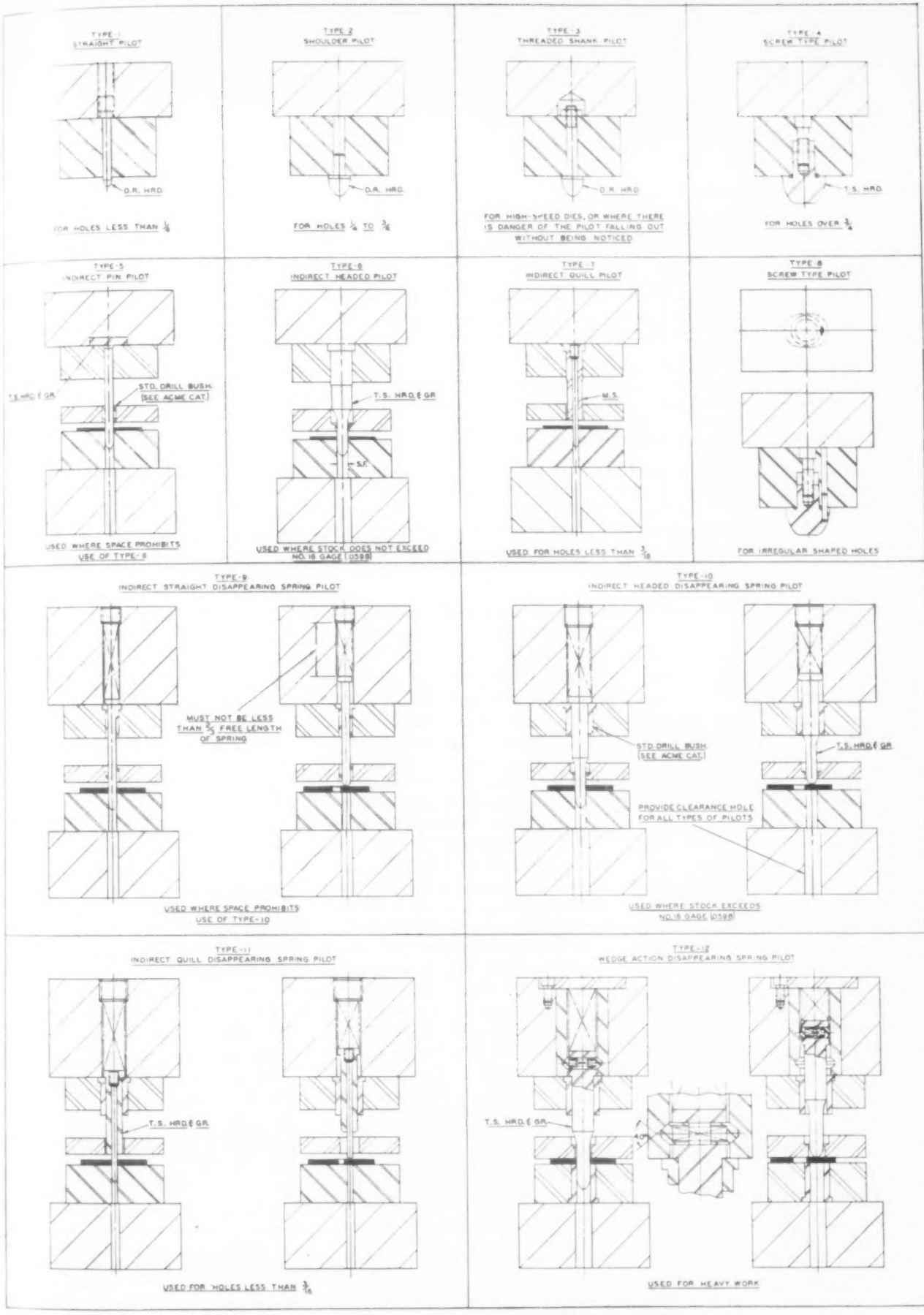
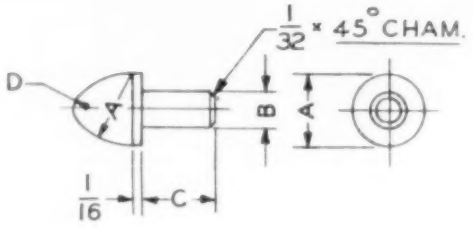
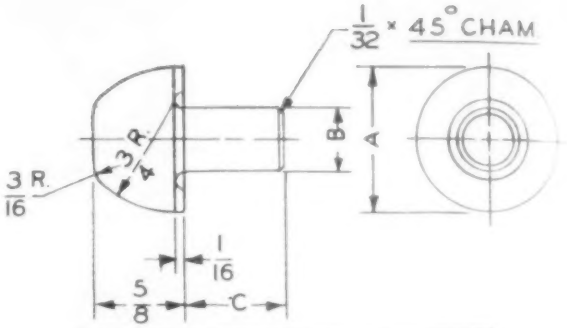


FIGURE 3. TWELVE TYPES OF PILOTS FOR PROGRESSIVE DIES.



A	B	C	D	MAT.
3/16	1/8	5/16	1/32	D.R.
1/4	3/16	7/16	1/32	D.R.
5/16	1/4	1/2	1/16	D.R.
3/8	1/4	1/2	1/16	D.R.
7/16	1/4	1/2	3/32	D.R.
1/2	1/4	1/2	1/8	D.R.
5/8	5/16	9/16	5/32	D.R.

Standard pilots



A	B	C	MAT.
11/16	5/16	9/16	D.R.
3/4	3/8	5/8	D.R.
7/8	3/8	5/8	T.S.
1	7/16	11/16	T.S.
1 1/4	1/2	3/4	T.S.

All pilots hardened but not ground

Tables of dimensions and materials recommended for standard pilots.

thickness of stock, width of strip, and length of strip, no formula has been developed to compute the correct pressure. In practice the proper pressure for the job at hand is found by trial-and-error in the toolroom. The designer specifies the spring in the stock list simply as S. W. (spring wire), and calls for a spring to suit.

Sometimes the diemaker will find that he can use a standard spring satisfactorily. At other times he will have to wind special ones. Under all conditions enough space must be provided for the spring to work in. When the spring is compressed the space occupied by it should not be less than two-thirds of its free length. (see note, type 9 pilot).

● **Type 12,** a wedge-action spring pilot, is used when the stock being fed through a die is heavy or the sheet is wide and long and enough pressure cannot always be provided with a spring pilot to pull the sheet along. The unit is similar in construction to that of type 10.

A large, thick head is provided on the pilot. A hole is reamed through this head and two round pieces with conical ends and separated by a small coil spring are inserted. These pieces, held in position by the spring, have their conical ends fitting in a groove in a hardened bushing which has angles corresponding to that of the pieces themselves. When the die is operating normally the pilot retains the position shown in the illustration at the left.

In case of a misfeed the conical pieces are forced into the head of the pilot and the pilot is allowed to recede by compressing the large spring as shown at the right. The advantage of this type of pilot lies in the fact that a large amount of pressure is required (much more than can be obtained by a spring alone) to cause the pilot to be pushed up. This pressure can be made to suit by varying the angle and of the groove on the conical end of the two pieces. A 40° angle as shown on the enlarged view is suitable for average conditions.

In every type illustrated, a hole is provided which is coaxial with the pilot. This hole goes clear through the die section and even through the die holder. Moreover, when the die setter sets the die in the press he must be as careful to provide a continuation of this hole as an outlet for slugs, just as if the pilot were a piercing punch. If only blind holes were provided, only a few misfeeds would cause the slugs to fill up the hole and finally break the pilot.

This precaution is even necessary with spring-backed pilots. Although the latter are not expected to pierce holes, they often do if the spring behind them is too strong. The hole in the detail which receives the pilot and on which the stock rests must be in hardened tool steel or a tool steel button provided as shown in type 10.

THE END.

● Thousands of tons of light household scrap, collected last Fall, will be useless unless mixed with heavy, industrial scrap — still wasting in plants. Considerable broken machinery, old bolts and nuts, and discarded equipment are laying dormant, protected by plants which thought the job was finished by one scrap drive. Some is harbored by ineffectual salvage programs. For details on how to make salvage a good business, write THE TOOL ENGINEER or The Industrial Salvage Division, War Production Board.

Inaccuracies in rough machined bores are selectively removed by honing. Producing finished products, this tool soaks up the variables, generates precise accuracies.

HONING- a Precision Production Process

JEROME S. WILFORD
ASSOCIATE EDITOR

HONING is among the production tools receiving added impetus in application because of the demand for greater and more precise production. As with other conventional methods of processing, honing is used as a matter of course by many production engineers. But there is probably a majority of tool supervisors, master mechanics, methods engineers, call them what you will, who if they have not misunderstood the function of honing, at least were uneducated to its benefits by the master instructor in tool engineering, experience.

Demands for precision production in the aircraft industry have made manufacture of certain machined parts natural fields for honing applications. Aside from plane armaments, the production of engine and landing gear parts has shown effective use of this tool.

AIRCRAFT ENGINE PRODUCTION

Need for lightness in plane parts means a high power to weight ratio. Thin cylinder walls must be constructed with a precision that allows perfect distribution of load and stress. At the same time, the material is of a hardness not known to engine construction a few years ago. For example, on one radial engine job, cylinders show a hardness of approximately 350 on the Brinell scale.

Following grinding, honing is applied to remove about .0015-inch on the diameter in one operation to correct any dimensional inaccuracies of diameter throughout, lack of conformity to axis, or surface finish irregularities within this dimension. Accuracy for roundness and straightness is held between .0003 and .0005-inches. Surface finish was formerly accurate to 1.8 to 2.5 microinches rms; recently this limit has been increased to 8 to 10 microinches rms. Operation time is seven minutes, floor to floor.

With similar accuracy and operation time, honing is applied to remove .001-inch of stock on the diameter from nitralloy cylinders which show a Brinell hardness of 800 or better.

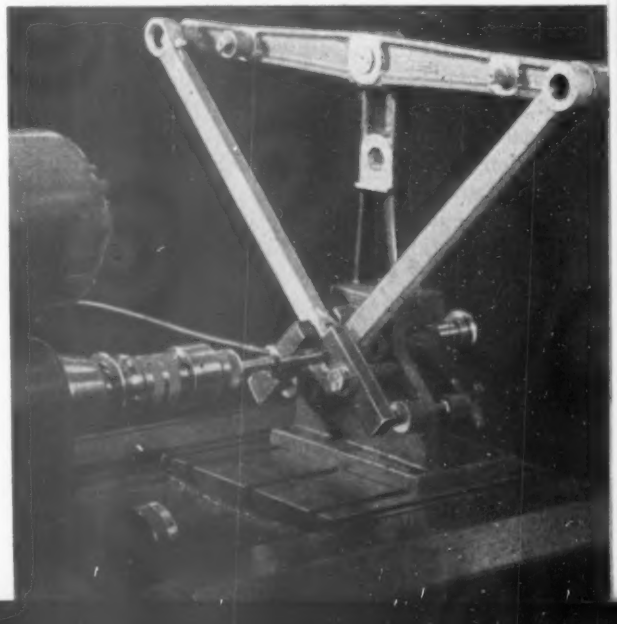
In the early 1930's, one of the serious limitations imposed upon honing was in its inapplicability to finishing parts where the diameter of the bore was greater than bore length. Dependency of the tool's operation upon sufficient length to bridge irregularities in dimension and upon the accuracy of previous machining operations ruled out application to bore lengths less than diameter. Universal action and freedom of the stones to expand was influenced more by the space outside the bore than by the walls of the cylinder.

Because freedom of tool action was essential, there seemed little that could be done to alter design of the honing stones or sticks with respect to the method of holding them in the tool. Solution however, for a number of applications was relatively simple, without affecting the tool in the slightest. By means of ingenious work-holding fixtures, numerous types of short bore parts might be stacked one upon the other and honed simultaneously. Not the least of the benefits of solving this problem was increased production and assured interchangeability.

Where parts could not be honed simultaneously, piloting devices were developed. In certain cases, one of the advantages of tool design was lost. The accuracy of honing has not generally depended upon exact location of the work with relation to the tool. Free universal action of the tool body, and its ability to find and develop the neutral axis has permitted it to generate finer accuracy than was built into the work holding device. However, piloting transferred this burden of location to the work-holding jig.

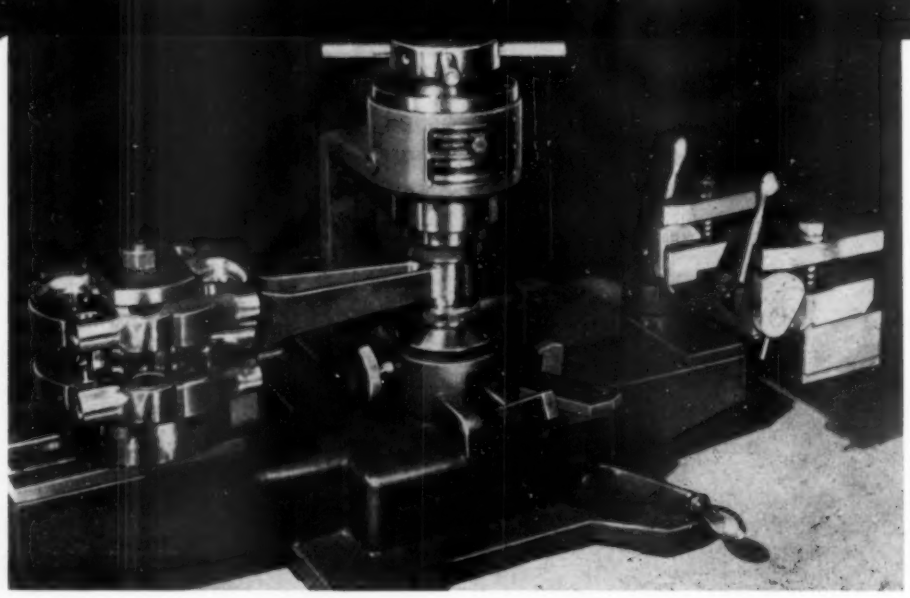
Pilot bearings on the tool were usually located above the work. This not only permitted work in blind holes, but permitted the pilot to be of any practicable diameter, in that the pilot bearing did not have to pass through the work.

Aircraft landing gear retracting links are fitted with steel bushings which are hone finished after assembly into the links. Relatively short bores are honed two at a time on a fixture which locates the bores accurately with respect to each other. From .002 to .003-inches of stock are removed in one operation following grinding. Accuracy for round and straight is generated within .0005-inch, and surface finish within 5 to 8 microinches.



Landing gear retracting links are honed in pairs by hydraulically controlled machine. By machining two at a time, depth of bore is in favorable ratio to the diameter.

Micromatic Hone Corporation Photos



Combination fixture for honing wrist pin and crank pin bores in master connecting rod and bores in articulated rods. Master rod is being honed here.

Virtually no limits are placed on the overall size of work which can be finished by honing. At present, the largest tools and machine built have been for work up to 41-inches diameter and 75-feet long. From the largest caliber gun barrels to injectors for diesel engines, honing has the same job of producing accurate diameters, true axis and smooth surfaces. Honing, being usually the final processing operation, is expected to correct all previous machining errors, while generating final size, accuracy and finish.

Honing, therefore, has had to develop operating controls to remove stock selectively in any portion of a bore and in sufficient quantity to maintain uniform, final results in production. There may, however, be a difference in the end result with regard to finish. This is illustrated in gun manufacture.

Huge horizontal machines and tools have been designed and built to hone gun bores. Three honing operations are usually used in gun manufacture. Rough honing is frequently used for preliminary inspection of forgings and to remove stock to correct taper and establish approximate diameter size. Finish honing produces finally accurate diameters and axial conformity or circumferential accuracy. These operations are sometimes followed by a third variation — straight line honing, a method of producing predominant smoothness in the direction of wear, or parallel to the axis.

Known as "co-directional finishing," straight line honing incorporates a special tool with interlocking stones, though its use is optional for conventional finish honing where heavy stock removal is not mandatory. Such a tool may be used for finish honing, where the object is to establish accurate circumference and diameters, and within this accuracy a surface finish of from five to seven microinches rms. Then the rotation of the tool may be stopped and a reciprocal longitudinal motion activated with controlled indexing between strokes.

Stock removal in this operation is primarily for surface finish which may range from 1.5 to 5 microinches rms. longitudinally, though an annular reading would be changed hardly at all. It is a true honing operation, though it is not intended to generate or correct major accuracy of dimensions. Indexing the tool compensates for minute differences in cutting performance between any portions of the stones, and maintains previously established accuracies.

HONING FUNDAMENTALS

HONING is applied to generate finished surfaces in cylinder bores or on external surfaces of certain cylindrical parts. Fundamentally, honing tools are designed to remove stock selectively, to produce a bore of high uniform dimensional accuracy. They will generate a true circle or diameter around the neutral axis developed by boring or grinding and will control and develop constant diameters and produce a fine finish.

Though stock removal is necessary to attain these objectives, it is only the means to the end. Large scale stock removal is not a prime objective of honing. A prime objective, mentioned above, is control of stock removal, or, to remove stock selectively. This means to take out a relatively large amount of stock in those parts of the bore which are constricted in relation to the neutral axis, and quickly to equalize the stock removal in establishing the neutral axis.

The conventional honing set-up consists of a variable, but symmetrical arrangement of sticks of bonded abrasive grains around a revolving tool within which are controls for applying expanding pressure on the stones. Sticks, or stones, are secured so that one or both ends are free to pivot upon application of expanding pressure. With accurate pressure control, this permits selection of cutting depth or penetration of the grains into the workpiece. Under a given pressure, the introduction of the tool into a tapering bore will make resistance to the pressure increase and cutting depth will be greater. Thus the tool corrects taper within overall stock removal.

A slightly "snaky" or curved section of the bore will be corrected because the expansion pressure of the stones will be greater as they revolve past one side of the cylinder than the other. As the entire bore is honed and corrected for accuracy, the increase of stock removed — or widening bore —decreases expanding pressure (pressure control generally may call for additional decrease) and abrasion is lessened so as to approach a smoothing or finishing cutting action. Universal connections between the tool and machine spindle assure proper alignment of the tool so that it is free to follow the path of least resistance in the bore and generate accurate diameters around the neutral axis developed in boring and grinding.

Hundreds of thousands and millions of crystalline grains — ranging from 60 to 80 grit size to the smallest available are bonded into a honing stick or stone. With respect to their cleavage planes, these grains lie at every possible angle to each other. Tools are introduced into the work in a combined rotating and longitudinal action which develops a multidirectional path so that the direction of cutting force is constantly changed. The grains are thus presented to the work from ever changing angles, and within an exceedingly short period, application for every exposed crystal

will be in conformity with the cleavage angle. When the grain is so actuated, it will fracture frequently, and present a new cutting edge to the workpiece. Uniform cutting action and self-dressing of the abrasive stick are thus retained.

In addition to the control of positive expansion, which aids in developing accuracy of diameters and circumference, and in correcting taper, an important factor in this same development is the reciprocal or reverse stroking of the tool through the bore.

SPEED OF OPERATION

Closely related to the function of direction of motion is the speed of application. As in any machining ratio, high rates of motion tend to prevent penetration of cutting edges into the work. A burnishing or rubbing action is set up, work-hardening develops and the cutting edges are rapidly dulled. High speed may also develop rapid heating and cooling, induce fatigue cracks. Because of the tremendous number of cutting contacts utilized in honing, both low speed and relatively low expanding pressure, or depth of cut, may be employed. Finishing operations employ even lower equivalents than roughing.

Depending upon the amount of stock to be removed—that is whether the operation is for rough or finish work — surface speeds in honing may range from 10 to 250 feet per minute. In most applications, it is below 200 surface feet per minute.

Speeds and direction of motion, rate and pattern of traverse are all controllable, either automatically, or by selection while in operation. The pattern of cutting action is usually shown in a cross-hatch diagram. Stress, or predominance of cutting action in a sector of the workpiece can be achieved by reciprocation within a specified area of the workpiece.

As pointed out above, straight line honing, where there is only longitudinal reciprocation and no revolution of the tool except to index at the end of a stroke, is in use where the wear on the finished product is parallel to the axis. The effect of straight honing as shown by Profilometer and Brush readings is to produce a smoother surface in the direction of wear than is traced by following the circumference of the bore.

Controls of pressure and expansion are available in a variety of systems. A hand brake type of mechanical adjustment depends upon the skill of the operator in maintaining a pattern of pressure. The usual operating procedure is to build to progessively higher pressures and then taper off for fine finish.

Expansion of the honing sticks by means of springs provides an automatic control, with decrease in pressure as the spring elongates. Though the variety of pressure patterns is limited, this process is entirely suitable for finish honing.

Hydraulic controls have brought a further high degree of advancement to the honing process. Pressure combinations are available in unlimited variety during the working cycle. Stock removal and surface finish are perfectly controlled.

•

Honing is essentially a wet cutting operation, requiring a copious supply of clean cutting fluid. This is necessary to control shearing action by producing a favorable type of chip formation — an absolute requirement of low tolerance finish specifications. Cutting fluid also supports the abrasive, that is tends to hold it off the work, preventing its complete penetration, a factor closely allied to chip control. Cutting fluid must also act as a coolant, carrying off excessive heat and flushing chips and grits from the working area.

THE END.

On this four stage connecting rod fixture, large end, shallow bores are held in full floating, unclamped position.

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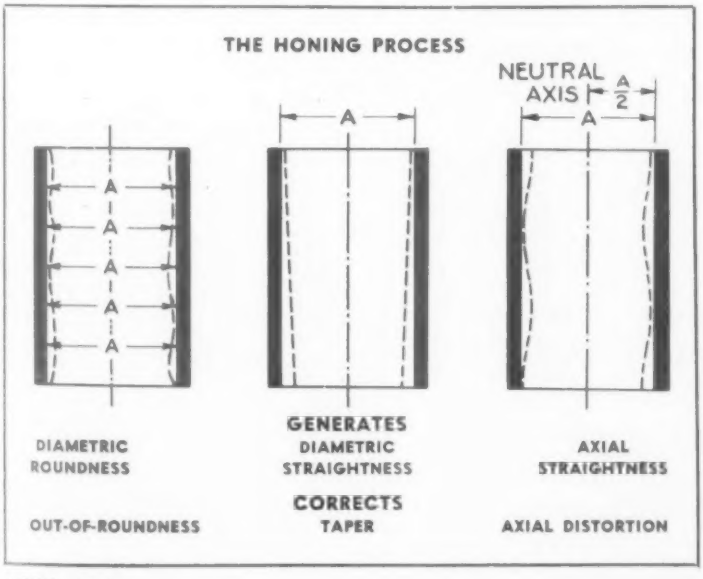
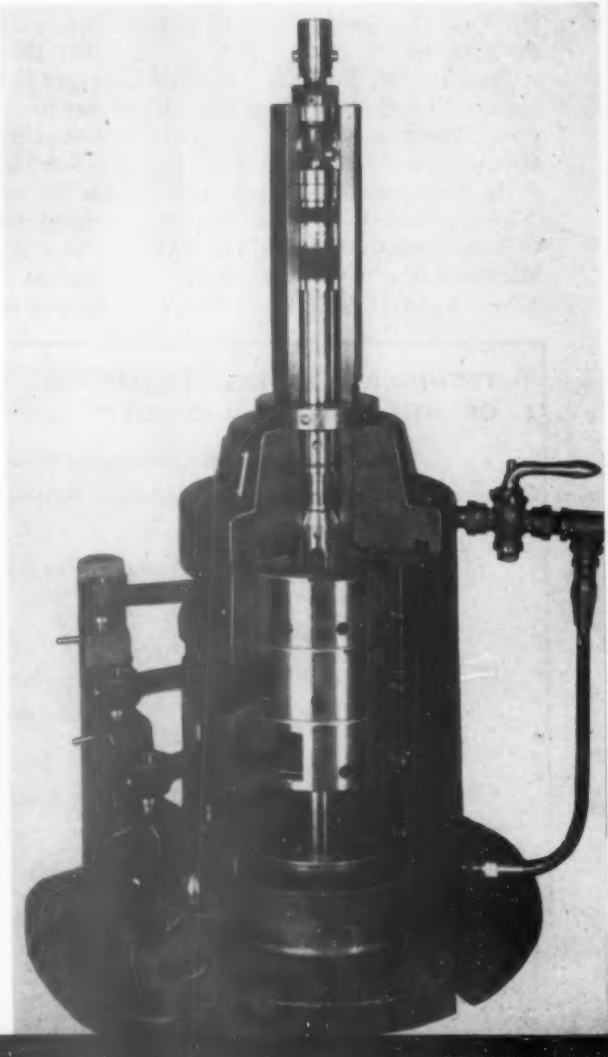
Drawings show, with dotted lines, unequal diameters, taper and curved axis. Heavy black lines show bore following honing operation. Fine finish is not indicated.





"KNOW-HOW"

Keynotes Milwaukee Meeting of Tool Engineers

DEDICATING themselves to the wartime task of passing along the technical "know-how", nearly 1,000 members of the American Society of Tool Engineers convened in Milwaukee, Wisconsin, March 25, 26 and 27 for their 11th Annual Meeting.

Concurrent with the meeting and a series of technical sessions on new and vital techinques in mass manufacturing for victory, the Tool Engineers presented a War Production Edition of the Machine & Tool Progress Exhibition. It was accorded one of the most favorable receptions ever received by this bi-annual Society presentation.

New National Officers

Highlight of the conclave was the election of Ray H. Morris, Hartford, Conn., as new President of this organization of 12,473 American and Canadian production expediters. Morris is Vice President of Hardinge Brothers, Inc.

Douglas D. Burnside, Superintendent, Quick Meal Stove Co., Division, American Stove Co., St. Louis, Mo., was named First Vice President of the Society for the 1943-44 term.

New Second Vice President is C. V. Briner, Sales Manager, The Pipe Machinery Co., Cleveland, Ohio.

New National Secretary is Earl V. Johnson, Production Specialist, Firth-Sterling Steel Co., Dayton, Ohio.

Floyd W. Eaton, who left industry to assume a position in the War Manpower Commission, Detroit, was selected as Treasurer.

Adrian L. Potter, Detroit, was reappointed Executive-Secretary.

Despite war-time complications of transportation, housing and their own responsibilities on the production front, 946 members left shops and plants from coast to coast to attend the three day gathering. The Machine & Tool Progress Exhibition, staged in Milwaukee's huge Auditorium, attracted approximately 10,000 production-wise men interested in new machine tools and metal fabricating accessories.

New machines displayed

The Exhibition, which presented 138 exhibits and covered 50,000 square feet of floor space, revealed that though industry has been engaged in turning out the maximum in war production equipment, it has not been idle from a development standpoint. Demonstrated for the first time in the lakeside city show were numerous new machines and processes which should go far toward expediting the war production effort, and presage radical departures in post war mass manufacturing techniques.

With a production record behind them of having accomplished in one year what it took Hitler seven years to do, as many as 500 engineers at a time attended the series of six technical sessions held in the Auditorium.

Philadelphia next year

These sessions, described by the retiring A. S. T. E. President, Otto W. Winter, President, Sav-Way Industries, Detroit, as the most outstanding in the history of the Society, were concerned primarily with three problems: how to get greater output of war material from the nation's natural resources; how to adapt production methods to make them more suitable to the employment of women, and how to train these women; and the development of new techniques which would speed the war output and lower production costs.

Climax of the Annual A. S. T. E. dinner, at which the Society's new national officers were inducted, was an address by Brig. General H. F. Safford, Chief of Production Service, Army Ordnance Division.

After charging the Tool Engineers with the responsibility for carrying to ultimate victory the battle on the production front, he complimented his audience of 750 in Milwaukee's Schroeder Hotel with making possible the greatest production record in history.

Scoffing at reports that the tooling job for war is largely completed, General Safford said, "This war isn't over for you Tool Engineers. You must be prepared to pitch in and tool up for new weapons. Today's war is a fluid thing, and the weapon that will win it may not yet be conceived."

In his final address as retiring A. S. T. E. President, Winter reviewed the Society's accomplishments during the past year. He cited the addition of 3,000 members and five new charters.

The Society will hold its 12th Annual Meeting in Philadelphia in March, 1944, it was announced. The organization's next semi-annual meeting will be held in Indianapolis next October. THE END.

TECHNICAL PAPERS FROM THE ANNUAL MEETING OF THE AMERICAN SOCIETY OF TOOL ENGINEERS.

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- Other significant papers presented in technical sessions at Milwaukee last month will be published in subsequent issues of THE TOOL ENGINEER.
- The pageantry and personalities of the Machine & Tool Progress Exhibition and A.S.T.E. Annual Meeting are scheduled for review in THE TOOL ENGINEER'S "Handy Andy Says—" column next month.

Tools and Methods for High Speed Machining

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● For production engineers who think negative rake — or any rakes, clearances or angles will cure everything from a bad lathe tool to chilblains, here is a discussion of other factors which vitally affect machine and tool efficiency.

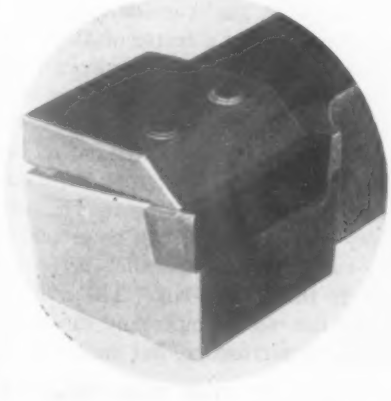
So much has been written about feeds and speeds that there is an authority for any feed or speed an operator may wish to use. Further figures on these factors, as well as on angles, clearances, and rakes are unnecessary. The best way to determine these is by trial.

Concerning other factors in tool design and use, a short account of a few experiments recently made by the Bell Aircraft Corporation plainly indicates some interesting conclusions.

Figure 2, a carbide tool with cutting edge, as provided by manufacturer, ruined by chip breaker. Nicely polished top surface is absolutely useless.

●

Figure 3, applied chip breaker preserves carbide tools original cutting edge.



At least three trends are clearly demonstrated that can be attended to with profit. They are:

1. Because conventional milling cutters present a problem whereby the operator must select insufficient feed for proper use of the tool, or not have enough power to drive it, the trend is to have fewer teeth.
2. Redesign of chip breakers on turning tools is a trend that will show benefits if it leaves cutting edges, as delivered by the manufacturer, unimpaired. Many demands for chip breakers are uncalled for.
3. Greater use of cast alloy tool tips can improve production.

Why these trends are indicated can be shown most easily by describing some of the work at Bell.

Though a cap strip mill operation is a familiar sight, the cutters used on this particular job at Bell are unusual. In the experimental stage of their development, the attempt was made to remove the amount of material indicated in Figure 1. More than one cut would slow down production, which had to be avoided. It was distinctly a question of torque or power. By the usual method, 100 hp would be barely enough. According to available books, about 1,000 hp would be required.

The ordinary two-bladed cutter normally used on these machines required more power than was available. So a cutter was designed to remove the maximum material with minimum horsepower. The one-bladed cutter in four parts, shown in Figure 1, was designed. Each of the four sections had only one blade in it, set 90° apart so that one blade was always in the cut. Shear angle was increased to 30° instead of the normal 10°. The idea was to slow feed 50 percent and so use less power. This operation consumed 52 9/10 electrical horsepower, using a feed of 22-inches per minute and producing 75 gallons of shavings per minute.

Since inclusion of this operation in regular production, the cutter has been started about an inch deeper

Figure 1, unconventional cutter removes material as shown in one cut.
Bell Aircraft Photos

than shown in the illustration, and it gradually climbs to nothing in about eight feet. This cutter performs with remarkable smoothness and quietness, and only the voltmeter and ammeter make one realize that up to 80 hp are required to drive it.

Specifications for this cutter are: front rake 12° at center of blade; clearance 5°; bodies are malleable castings; blades cast alloy.

This brings up the first of the three trends — that toward fewer blades on milling cutters. Most tool engineers have stood beside a milling machine and heard a cutter, 28 teeth or so, crunch and squeak through the work. When the cutter is removed it may be seen that only about three teeth worked, 23 were idlers, and two only skated over the work and consumed power, and also made a compacted, glazed surface for one of the three active blades to bite through. This may seem exaggerated, but it does point out what happens.

It is generally recognized that milling cutters seldom run true, and that a mill seldom makes a chip less than .002-inches thick. It is also known that to obtain a chip of that thickness, there must be a forward feed of about .010-inch, or more, per tooth depending on the depth of cut. But, if there are .280-inches per revolution times about 80 revolutions per minute — a little over 22-inches per minute, and if there is any real depth to this cut, the motor would soon stall.

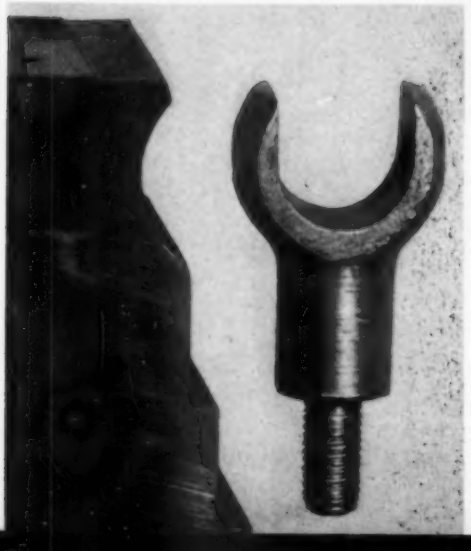
The answer is obvious. If six out of every seven teeth are removed, four are left, which reduces feed by 6/7ths, or to about 2¼-inches per minute. With plenty of power now available, feed can be stepped up to about four inches per minute. This gives each of the four teeth a healthy bite, and believe it or not, smoother finish and faster production.

About a year ago, an article appeared in THE TOOL ENGINEER on speeds and feeds for milling. In one case, a cutter was described as being approximately seven inches in diameter, operated at 80 rpm, with a depth of cut of ¼-inch, and feed of ½-inch per minute. If that cutter had a normal 24 teeth, 80 rpm would make 1,920 teeth per minute fighting over the available .500 advance, not to mention the effect of the angle of the four inch radius on the ¼-inch depth.

Now, suppose feed is increased to a minimum of .010 per blade. That would make each blade take a shaving approximately .001-inch thick, and feed would be about 20-inches per minute. Few milling machines would have the necessary power to drive this cutter if every blade took an actual bite. A two-horned dilemma is presented. Either choose insufficient feed to use the tool as it should be used, or be faced with insufficient power to drive it.

Ninety percent of the milling cutters now in use or hanging in tool cribs present this problem.

Figure 4, applying chip breaker entirely separate from cutting portion might be useful—if just the right job is found for it.



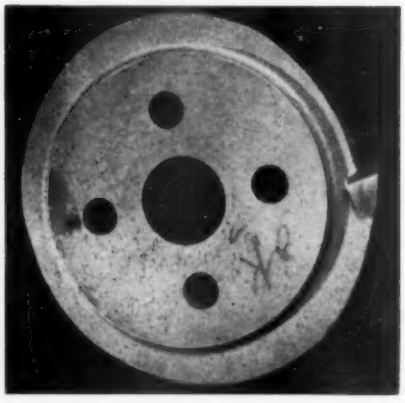


Figure 5, above, cast alloy cutting tools are taking their place on certain jobs.

●

Figure 6, cast alloy form tool and the 9,000th part produced without a regrind.

Caution advised

With fewer teeth, a further saving in critical material by brazing high speed steel, or other material, to cutter bodies of malleable casting, cast iron, meehanite, cast steel, machine steel, or boiler plate, becomes more practicable.

Put enough teeth on this body to load the machine, but not overload it. This will generally call for one to six blades. One caution, try brazing or welding cutter material first, because any inserted tooth cutter may suffer from vibration, particularly individual blade vibration.

Three results are:

1. Pounds of critical material are saved.
2. Cost and time are saved in that this tool can be readily made or obtained.
3. The cutter will last longer at higher speeds and much faster feeds, and leave a better finish because each blade takes a clean bite and there is power enough to drive it.

Now for trend two, and the use of chip breakers. Carbide tipped tools as delivered by the manufacturers have as keen an edge as can be developed for this material, nice finish and absence of grinding marks. Figure 2 shows such a tool after a stop at the grinding crib. The poor finish of the chip breaker is immediately noticeable. Grinding ridges run parallel to the cutting edge, and the remaining nicely polished top surface is absolutely useless as the chip will not touch it, much less slide on it.

Recently, a carbide tool was noticed turning a sector of about 70° of a circle with a chip breaker ground into it. The chip could not have been more than 1½-inches long. There was nothing it could catch on, yet because it was a carbide tool, there had to be a chip breaker on it. The only way a chip breaker can be ground is to run the ridges parallel, or nearly so, to the cutting edge. These ridges may not seem important until put under a microscope, but such inspec-

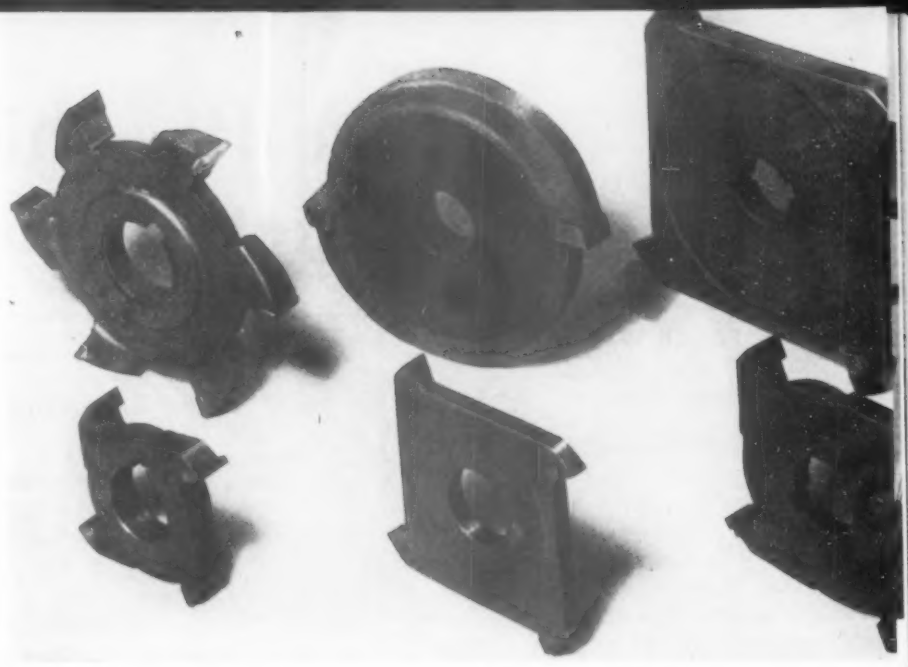


Figure 2. some of the cutters with blades brazed to various uncritical metal bodies, saving high speed steel.

tion shows that the chip is kept from sliding freely, not only by the chip breaker but by the ridges left by grinding.

In experiments at the Bell plant, with cutting tools, either in the laboratory or in practical use, the one thing that stood out was that the efficiency and the life of the tool depended to a great extent on the free sliding of the chip on the tool. Any interference with this free sliding, be it roughness, natural high friction of the material, porosity or chip breakers, reduces the performance of the tool and encourages building up on the tool tip. Quite often, the fracture of the cutting edge is caused directly by inability of the chip to get away.

Of course, the chip must be broken for disposal, but why not do away with spoiling the tool before use? A trend, not a finished accomplishment, may be indicated by two attempts which Bell engineers have made to solve this problem. These partly successful ideas are illustrated in Figures 3 and 4. On one tool, an applied chip breaker was used. A recess was ground in the carbide tip to keep the chip from sliding underneath, but this time the unused part of the clean top surface was ground away and the cutting edge left whole. On another tool, an old stunt was tried in applying a chip breaker entirely separate from the cutting portion of the tool. Floating above tool, but so placed as to prevent the chip from curling, this works fine if — and it is a big if — there can be found just the right place for it. Naturally it varies for shapes and cuts.

These are just pointers along the way, but if efforts in this direction are successful, tools will last two to five times longer.

Now for the third and last trend. It would be hard to say that mince pie is best, pumpkin pie good and apple pie simply no good at all. Some like one kind, some another, and some eat too much of all.

three general classes

In cutting materials, we fail to follow this line of thought however. There are three general classes — the carbides, the non-ferrous cast metals, and the high speed steels. Like pies, they all have their uses. But up until now, the cast alloys have not been used to the extent that they would seem to deserve. Lately, the use of more of these alloys in place of high speed steel was proposed at Bell. The consensus of opinion from personnel, workers and management alike was that if a change was made, carbides were the only alternative. There seemed to be no way station. That is similar to saying that if you don't eat apple pie, go directly to mince meat and don't try pumpkin.

Several cast alloys have proved themselves. One of them used to a great extent has shown results not obtainable for like operations from high speed steel or carbides. One example is shown in the high speed spar cap milling machines, with a cutter as illustrated in Figure 5. High speed steel was tried with poor results, and various carbides proved erratic, and with the invariable result of major fracture of the blades, spoiling the part and certainly not improving spindles and bearings.

Investigation should be made of the usefulness of some of the non-ferrous cutting materials on the market. They all have in common some useful attributes, such as:

1. Ease of cutting, shaping and grinding. Diamond wheels are not only unnecessary, but cannot be used; but all other grits will work. The green silicate wheels are doing the best jobs at Bell. Open or porous structure wheels are also good.
2. High heat resistance, much more than for any high speed steel, means that the tool can be run at higher speeds, and that the material can be brazed to steel or cast shanks without danger of drawing the temper.
3. Sharpness is a factor because these cast alloys have a rather dense, small-grained structure, so much so that it would seem possible to make usable razor blades out of them.
4. They have a low friction coefficient, because of their close-grained structure and the metals commonly used in them, such as cobalt, nickel and chromium.

This absence of cratering accounts in part for a phenomenal success with some form tools. Figure 6 shows a tool after a long run. The part shown was the 9,000th produced without a tool regrind.

This may seem to be a eulogy for one class of cutting metals, but it is not intended as such. The intention is to point out some of the desirable features of what seems to be a neglected production factor. These non-ferrous alloys seem to fit better than anything else could in brazing or welding blades to soft bodies. About two minutes is all that is required to braze a blade in place. After brazing, the grinding crib can use the same machines and methods as employed on high speed steel cutters.

Figure 7 shows some cutters made along these lines. One is a four tooth cutter, the body cast to shape; another is made of boiler plate; still another in an interlocking cutter made of meehanite castings. These cutters are used with increased feeds and speeds on all kinds of ferrous and non-ferrous materials — from brass to heat-treated chrome-moly. The benefits of a smooth grind are well known, and it is more important in these alloys than in either high speed steel or carbides. THE END.

Future Possibilities of Induction Heating

FRANK W. CURTIS

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VAN NORMAN MACHINE TOOL COMPANY

WITHIN the near future, metal-working plants throughout the country, engaged in high or low production, will adapt themselves to methods of heating metals for hardening, brazing, soldering, forging, and melting that their most active imagination could not have thought possible a few years ago. The process, that of high-frequency induction heating, is going to result in the development of new manufacturing techniques that will offer two outstanding advantages to industry, an economical cost of heating metals and a high rate of production with uniform results.

Induction heating units, briefly speaking, comprise a series of electrical units that convert the current of the input-line-voltage to a high-frequency current, which in turn is coupled to an inductor or heating coil. The part to be heated is placed within the coil, but does not become a part of the closed electrical circuit. When power is applied to the circuit, however, heating of the workpiece begins immediately through induced currents of high-frequency generated from the induction coil. As illustrated in Figure 1, water passes through the induction coil, when in use, to keep it cool and the only heat generated is into the workpiece itself. The coil is wound to fit the contour of the work, generally with a clearance of about 3/32 to 1/8-inch.

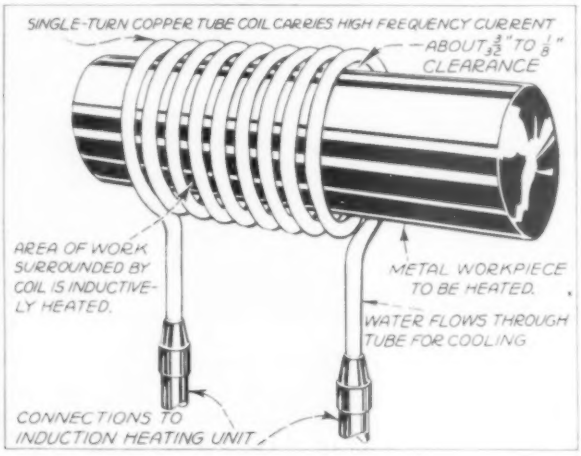
SINGLE-TURN COPPER TUBE COIL CARRIES HIGH FREQUENCY CURRENT
ABOUT 3/32" TO 1/8" CLEARANCE
AREA OF WORK SURROUNDED BY COIL IS INDUCTIVELY HEATED.
METAL WORKPIECE TO BE HEATED.
WATER FLOWS THROUGH TUBE FOR COOLING
CONNECTIONS TO INDUCTION HEATING UNIT

FIGURE 1.

Simple layout illustrating an induction heating coil and workpiece.

Induction heating units for industrial applications can be either of the low- or high-frequency type. Those operating at lower frequencies operate at about 9,600 cycles, as compared with frequencies of about 300,000 cycles, or more, with spark-gap and oscillator-type units. With the use of a higher frequency convertor is the advantage of obtaining a skin or shallow surface heating effect, which is so often desirable in connection with hardening operations.

With the use of high-frequency current, heat can be inducted to a predetermined area of a metal part requiring localized hardening, thus eliminating the expense of heating the entire part. Likewise, the heat can be controlled to the depth desired, even to the point of heating certain small types of parts throughout, in which case the core or center-section has a tendency to heat by conduction from the outer surface which, in turn, is heated by induction.

Another advantage of high-frequency heating is that parts of irregular shape, such as cams, can be heated uniformly around the surface if the variation in contour is not too severe. For example, in hardening a gear with medium pitch teeth the heat

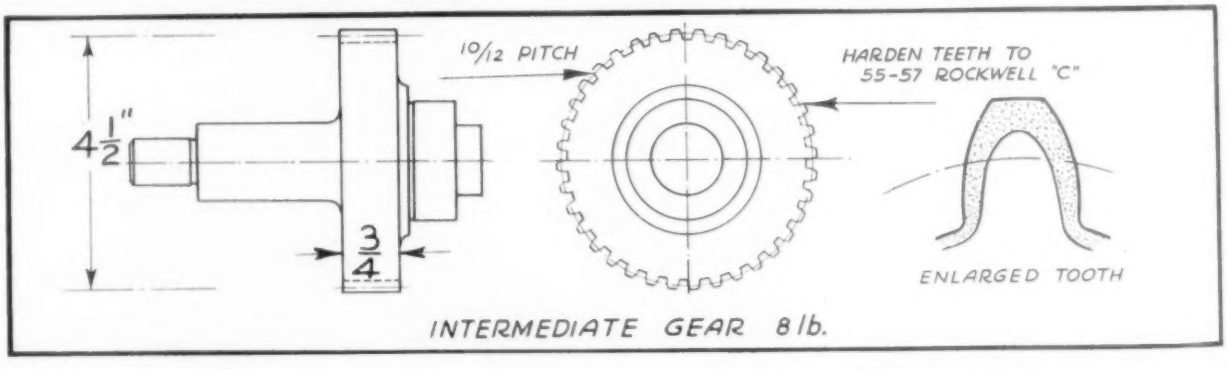

FIGURE 2. Comparison of costs of hardening gear teeth by carburizing SAE 1020 and by induction hardening SAE 1045.

COST AND OPERATION	SAE—1020 CARBURIZE	SAE—1045 INDUCTION
Cost of steel	.40	.43
Carburize @ .039 per lb.	.319	—
Cost of heat to harden	.041	.01
Cleaning	.02	—
Total cost	.78	.44
Saving		43%

pattern very definitely follows the contour of the tooth so that hardening can be confined to the wearing surfaces without impairing the toughness of the inner portion.

Case hardening

Case hardening is a very common form of heat treatment for metal parts and is, perhaps, one of the most outstanding applications for high-frequency induction hardening, when compared with former methods. Heretofore, the usual practice has been to use a low-carbon steel with a carbon range of .10 to .20, carburize in containers . . . or in a gas-charged furnace for several hours . . . depending upon the amount of penetration required, and finally reheating the part and quenching in oil or water as may be needed. Sometimes, this treatment is followed by a draw where a modified hardness is desired. In other cases, where hardness is to be limited to certain areas of the part, it becomes necessary to remove some of the carburized sections before hardening . . . or to copperplate the entire part and remove the plated area of the surfaces to be hardened before carburizing . . . , either method of which adds to the manufacturing cost.

With the induction heating process, a steel with a carbon range of .40 to .50 is used; heating is localized to the area to be hardened, without any appreciable effect to the remainder of the part; then, the heated surface is quenched as required. Practically no scale is formed at all during heating, warpage and deformation are exceptionally slight and in most cases do not exist; drawing becomes unnecessary because the entire part has not been subjected to heat, thus precluding internal strains. Likewise, there is a substantial saving in cost, largely through the elimination of carburizing, as well as in the cost of heating for hardening. A comparison of costs for a gear on which only the teeth are required hard is shown in Figure 2, resulting in the saving of 43 percent through the high-frequency induction heating method.

The analysis includes the cost of steel in both cases because this difference has a relation between carburizing and induction hardening costs. There is only a fraction of a cent per pound difference in cost between the higher and lower-carbon steels, but the carburizing cost runs about four cents per pound. The cost of heating

FIGURE 3. High-frequency induction heating unit for water-quenching steels. The quench ring and coil are placed so that entire hardening operation is handled with workpiece in one position. Part shown is a spur gear.

differs, too, since only a portion of the part is heated when induction hardening is applied, and the operating cost of the unit is comparatively low.

A gear of the size shown can be hardened in about 30 seconds floor-to-floor time, which includes 15 seconds for heating, eight seconds for quenching, and the balance for loading.

Control of hardness

Since the hardening cycle of a high-frequency heating unit is controlled by an automatic timer, it is possible to vary the hardness of a part, one way or another as may be desired, by a slight change in the heating and quenching time cycle. Assume a shaft two inches in diameter is to be case-hardened 1/16-inch deep at one end to 55 "C" Rockwell, the cycle would be to generate heat for about 10 seconds, a water quench for six seconds, and with the timer so set, piece after piece would be produced to this hardness with no appreciable variation. Now then, if a higher hardness were desired for the same piece, say 60 "C" Rockwell, this could be accomplished by either increasing the heat cycle slightly to about 11 seconds, or by increasing the pressure of the quench and duration of flow a slight amount, or perhaps both. If, on the other hand, a lower hardness were wanted, the

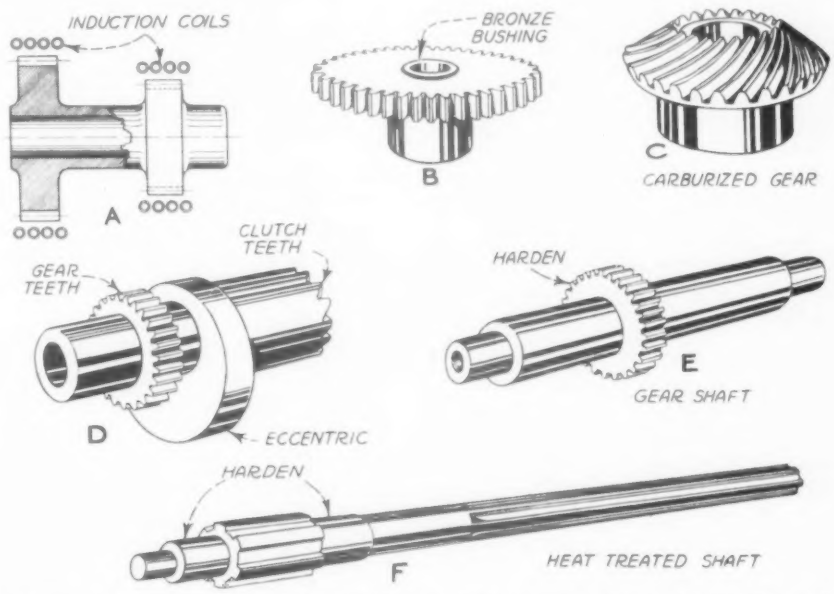

FIGURE 4. Parts to be induction hardened. "A" shows position of induction coils with relation to sections to be hardened.

length of quench could be reduced a second or so, or a half-second to a full-second delay could be incorporated between the end of the heat cycle and the start of the quench. If a relatively low-range hardness is required, it is possible to reduce the length of the quench materially so that the workpiece would be removed from the induction coil while still fairly hot, from which temperature it would draw itself down to the desired hardness. To go from one extreme to the other, heating a piece without any quench would result in annealing, and heating a piece and applying a full quench would result in maximum hardness. Therefore, by varying the heat and quench cycles, most any range of hardness can be obtained at will.

Generally speaking, most manufacturing-type steels can be hardened by high-frequency induction heating, providing the carbon content is sufficient to produce hardness by quenching. With oil-hardening steels, provision would have to be made to drop the heated piece into oil. With water-quenching steels, a suitable holding fixture with a quench ring and an induction coil can be supplied so that the entire hardening operation is handled with the workpiece in one position. Such a fixture is shown in Figure 3, the part being a spur gear.

Miscellaneous hardening

Other hardening operations showing the scope of high-frequency induction hardening are shown in Figure 4. The cluster gear *A* has both gear sections hardened, each being handled separately which is the usual practice with parts of this kind. The gear at *B* is provided with a bronze bushing, which can be pressed into place before cutting of the gear teeth since the heat generated during induction hardening will not reach the center portion of the blank. With induction heating, it is also possible to harden carburized parts such as the spiral bevel gear shown at *C*. This procedure is sometimes necessary on spiral gears because the eddy currents of the high-frequency current cause heating more on one side of the teeth than on the other.

Differential hardening, producing different degrees of hardness on the same piece, is also possible with high-frequency induction heating. On the part shown at *D*, the gear teeth are hardened to 54 "C" Rockwell, the eccentric to 62 "C", and the clutch teeth to 57 "C". With parts as shown at *E*, localized hardening by induction has many advantages, the outstanding being the absence of warpage which eliminates a costly straightening operation. Parts can also be heat-treated, to say 32-34 "C" Rockwell, then localized-hardened such as in the case of the shaft shown at *F* which has two surfaces hardened to 62 "C" Rockwell without affecting the heat-treated portions.

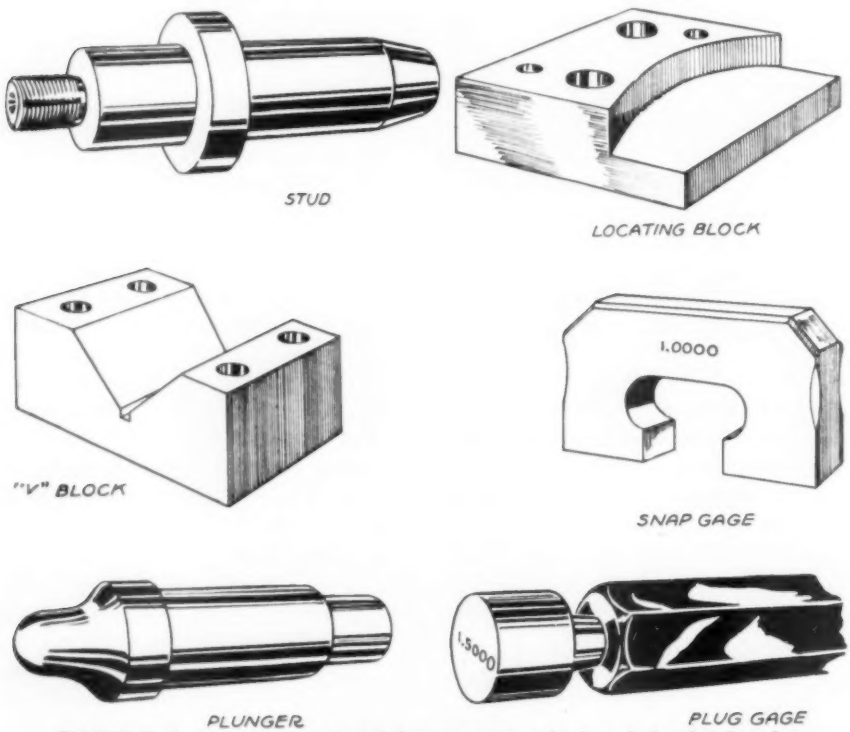

FIGURE 5. A variety of tool and fixture parts suited to induction heating.

While a steel having .40 carbon is satisfactory for high-frequency hardening, it must be remembered that carbon has more influence in connection with hardening than the addition of alloys. Even though a steel with carbon content of .35 can be successfully induction hardened, a steel with higher carbon is preferable, especially since the hardness can be controlled by means of timing as has already been explained. A very practical water-quenching steel for induction hardening is X-1340, now SAE C-1141, also C-1144. Because of the presence of manganese and sulphur in these grades of steel, they have excellent machining qualities, far better than either SAE-1040 or 1045, and seemingly the manganese and sulphur have no effect on hardenability with induction heating.

An ideal steel for high-frequency induction hardening application that has not been made so far, but which can well be visioned as a general all-purpose steel would be an X-1350, or perhaps X-1360 (C-1150 or C-1160). With good machinability and with suitable response to induction hardening, as it no doubt would possess, this steel could well fill the requirements for a very broad range of machine parts in many industries. In the meantime, C-1144 is the nearest approach to the solution, having about .45 carbon, 1.50 manganese, and .28 sulphur. This steel will suit the requirements of many parts where a hardness of 55 or 57 "C" Rockwell will suffice, but in those instances where a higher hardness is needed a carbon content of at least .50 would be the answer.

Toolroom uses

Before long, induction heating will find many uses in modern toolrooms and to some extent may change our principles of tool design. Fixture components, such as clamps, locating blocks, studs, bushings, V-blocks and plungers, can all be hardened by the induction process and where haste is a factor, no other method would prove faster or better. A variety of tool and fixture parts suited to induction heat-

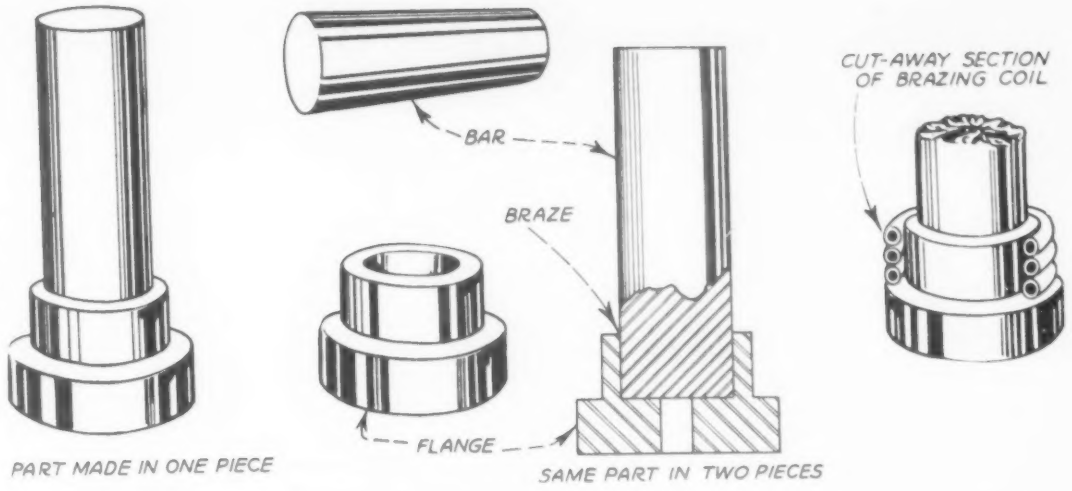

FIGURE 6.

Method of brazing two pieces with induction heating unit. Previously, one piece was machined or forged.

ing are illustrated in Figure 5. Another possibility in this connection is the hardening of fixture parts after they have been assembled to the base or body unit.

The wide scope of brazing, made possible by induction heating, will have an effect on engineering design. Parts now machined or forged in one piece may well be made of two or more pieces and joined together by induction brazing with, of course, a direct saving in material cost. Such an example is shown in Figure 6, representing a flanged shaft which could easily be made in two pieces, then joined together by induction brazing. The induction coil is made to surround the assembled pieces, which are centralized in and supported on a fixture. A formed ring of a small diameter brazing rod is placed on the flange, which when heated flows into the joint faces of both members and forms a solid bond.

Melting

Another practical use for induction heating is that of melting metals in relatively small charges. For this, a small crucible is used, preferably graphite, around which is wound a copper tube coil with an insulating layer of powdered alundum and asbestos, such as illustrated in Figure 7. The charge is placed in the crucible, which can be in the form of iron or steel chips. Heating such a charge, weighing from 10 to 30 pounds, requires from 50 to 60 minutes. The action of the high-frequency induction current causes agitation, on the order of a volcanic eruption, resulting in thorough mixing of the charge, especially desirable when alloys are used. A possibility for this use of high-frequency heating is the making of small castings in plants where foundry facilities are lacking. Another use in this direction, is the salvage of precious metals from floor sweepings, an idea already in practice at several plants. For the manufacture of small centrifugal castings, where small heats are required, induction heating has also proven of value.

Induction heating will result in new engineering principles and basic changes in materials for certain types of products. Less expensive designs will be made more practical, and critical or hard-to-get materials will give away to the simpler steels, which are easier to obtain and process. When the full possibilities of induction heating and hardening are exploited, fewer steels will be required for the usual variety of parts made in manufacturing plants so that small inventories will result.

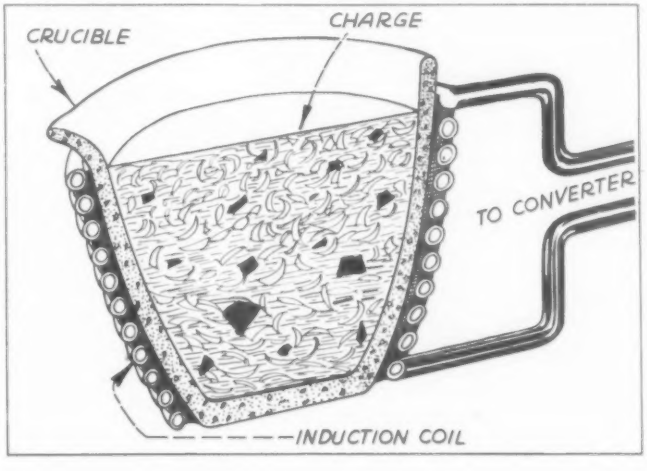

FIGURE 7.

Method of melting small charges of metal with induction heating unit.

Numerous practical advantages

Either high- or low-production methods will find induction heating practical. With standard forms of fixtures, change-overs from one job to another can be made in two or three minutes, making the handling of lots as low as six or 12 practical for processing. In high-production plants, induction heating units can be installed in the line so that after the rough-machining of parts they can be hardened, then passed to grinders, which can all be in the same department, eliminating transportation and trucking expense to a central heat-treating department.

There is no doubt but what the use of induction heating will increase rapidly in the immediate future for all types of heating operations . . . hardening, annealing, brazing, forging, soldering, and melting . . . and that many changes in our methods of manufacture will result because of the speed with which heat can be produced by high-frequency currents. Add to this the uniform results that induction heating offers, and it is obvious that this process will make possible the handling of jobs which can be done in no other way.

THE END.

The Machinability of National Emergency (N E) Steels

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AT THIS TIME, consideration of the machining characteristics of the newly developed low alloy steels must of necessity be based on meager data from the few available sources. Most of these steels are so new that definite procedures of heat treatment for machinability and machining practice have not been standardized. Revisions have been made repeatedly in "substituting substitutes for substitutes."

The revised N. E. steel specifications (approved December 17, 1942) are given here as Table 1. Only those whose work can justify it will be permitted to use the richer types of steels such as the NE 8442, 8600 series, 8720 series, 9500 series, 9600 series, and the 52100 series. The leaner, or low-alloy, types consist essentially of the NE 1300 series (carbon - manganese), NE 8020 (manganese-molybdenum), the 9200 series (silicon-manganese and silicon - manganese - chromium steels), and the 9400 series (manganese-silicon-chromium-nickel-molybdenum). Because of the critical manganese situation, it is doubtful that the N. E 1300 series of steels will be available for general use for any length of time.

It may be noted that the NE 1300 series, the 9200 series, and the 52100 series listed as NE steels correspond to the former AISI and SAE series of the same numbers.

Three classes of NE steels

National Emergency Steels may be divided into three general classes:

1. Carburizing steels containing up to 0.28 percent carbon are used where hard wearing surface is to be accompanied by good toughness and shock resistance in the core of the finished part. These steels may be machined in the hot rolled, annealed, or cold finished condition. The structure is blocked lamellar pearlite and free ferrite. Cold finishing improves their machinability.

2. So-called "semi-thorough hardening" grades containing from 0.28 to 0.40 percent carbon include the water- and oil-hardening types. They are generally used for tensile-strength ranges from 100,000 to 150,000 psi, with Brinell hardness ranging from 200 to 300. Some are used in the normalized, or normalized and tempered condition, with tensile strengths of 65,000 to 105,000 psi. These steels are best machined in the normalized or annealed condition, but may be machined at a sacrifice in speed in the cold finished or quenched and tempered condition.

3. The so-called "thorough hardening" grades containing more than 0.40 percent carbon, all of which are oil hardening, may be divided into the following four classes: (a) Those used in the full-hardened state, tempered to about 400° F. with resultant Brinell hardnesses of 550-600 and tensile strengths of 275,000 to 300,000 psi. (b) Those treated to Brinell hardnesses of 350 to 450, with tensile strengths of about 175,000 to 225,000 psi. (c) Those treated to Brinell hardnesses of 260 to 350 with tensile strengths of about 125,000 to 170,000 psi. (d) The high-carbon 52000 series used for bearing steels which have unusually high resistance to wear. Such steels are used at the maximum hardness obtainable for the section involved. The thorough hardening grades are best machined in an annealed condition, preferably with a spheroidized structure. However, it frequently happens that better machinability results from a normalized structure than from the annealed structure, even though the hardnesses are identical.

For and against NE steels

General statements from various users are not unanimous relative to the favorable machinability of the NE steels. One manufacturer of tractor hoists and cranes states "the steels are much harder to machine than the SAE steels they replace. The manganese seems to accumulate in hard spots or veins in the steel, making the machining operation extremely hard on tools. For this reason cemented carbide tools are more or less out because of their shattering under sudden shocks."

A manufacturer of transmissions states "when machining gears and shafts annealed to a Brinell hardness of 137 to 187 when turned with molybdenum high speed steel tools under an emulsion at 80 fpm with depth of cut 0.014 inch there has been no noticeable difference in machinability between the substitute steels now in use and the steels formerly used. It has not been necessary to alter physical properties, change the machining practice, or grind tools more often. It should be pointed out that our experience in actual production with the NE steels has been somewhat limited. Most of the work has been done with the NE 8000 series and the machining characteristics seem to compare favorably with those of the SAE 4320, the 6122-1, and the Amolas (NE 4000 series)."

A gear manufacturer advises that in replacing SAE 4620 steel with the rich alloy NE 8620 steel in turning operations based on speeds of 60 to 100 fpm and feeds of approximately 0.010 inch, no difficult problems were encountered. Regarding finish, many of the NE heats processed have given less trouble in turning and better surface finish than the SAE 4620 steel formerly used. This machining has been done with the material either annealed or normalized.

Case histories: NE 1300 series

Below are *case histories* submitted by users of NE steels.

The NE 1300 series steels of the carbon-manganese type comprise five specific analyses as NE 1330, NE 1335, NE 1340, NE 1345, and NE 1350. A company engaged in supplying cold finished steel reports that all of these grades in the as-rolled, cold-drawn condition have machinability ratings in percent based on Bessemer screw stock B 1112 having a cutting speed of 180 sfm (100 percent) with a favorable chip character designated as broken and hard, as follows:

NE 1330, 64%, or 115 sfm with a chip character continuous and

semi-hard
E 1335, 60%, or 110 sfm with a chip character continuous and hard
E 1340, 58%, or 105 sfm with a chip character continuous and hard
E 1345, 58%, or 105 sfm with a chip character continuous and hard
NE 1350, 53%, or 95 sfm with a chip character continuous and tough

The former AISI A 1320 steel which was not included in the NE list had, on a basis corresponding with the NE 1300 series steels above, a machining rating of 54 percent or 98 sfm. The chip character was continuous and hard.

The NE 52100 series of steels should be spheroidized annealed for best machinability. These steels machine with difficulty and in general may be rated at approximately 30 percent of that of Bessemer screw stock B 1112.

NE 8024 for SAE 3115

A tractor company reported substituting NE 8024 (Mn-Mo) for SAE 3115 (Ni-Cr) steel. The NE steel was machined in an annealed condition with a hardness ranging from 143 to 170 Brinell. Little distinction between the machinability of the new material and that formerly used was noticed.

NE 8620 for SAE 4620

A large gear machining company was reported using NE 8620 steel in place of the SAE 4620 formerly used. It was found that the average number of pieces per grind of the cutter on a three-spindle Gleason rougher when producing an 11-tooth differential side pinion averaged 420 pieces for both steels. The rougher had a cutter speed of 147 fpm and a feed of 16 seconds per tooth. The point width of cutter at the bottom of the cut was 0.110-inch and at the top of the cut 0.516-inch. The depth of cut was 0.375 and the length of the tooth face was one-inch. A sulphurized mineral oil was used as a cutting fluid and the steels were annealed for the machining operation to give a hardness of 143 to 163 Brinell and a blocky type structure of pearlite and ferrite.

When the above part was finished on an eight-inch manufacturing speed Gleason machine having 420 cutter strokes per minute and a feed of five seconds per tooth, removing 0.030-inch stock from each side to a tooth depth of 0.370-inch, the average number of pieces per grind of the cutter was from 100 to 110 for both steels. Again the sulphurized mineral oil was used as a cutting fluid. The finish as determined by meshing the teeth with a master on a spring fixture to observe eccentricity readings, and judging the variations in bearing position, showed no particular difference between the two steels.

When rough cutting a 16-tooth differential side gear on a Gould and Eberhardt bevel gear rougher using a cutting speed of 271 fpm and a feed of 4.6-inch per minute, practically no difference in machinability was found

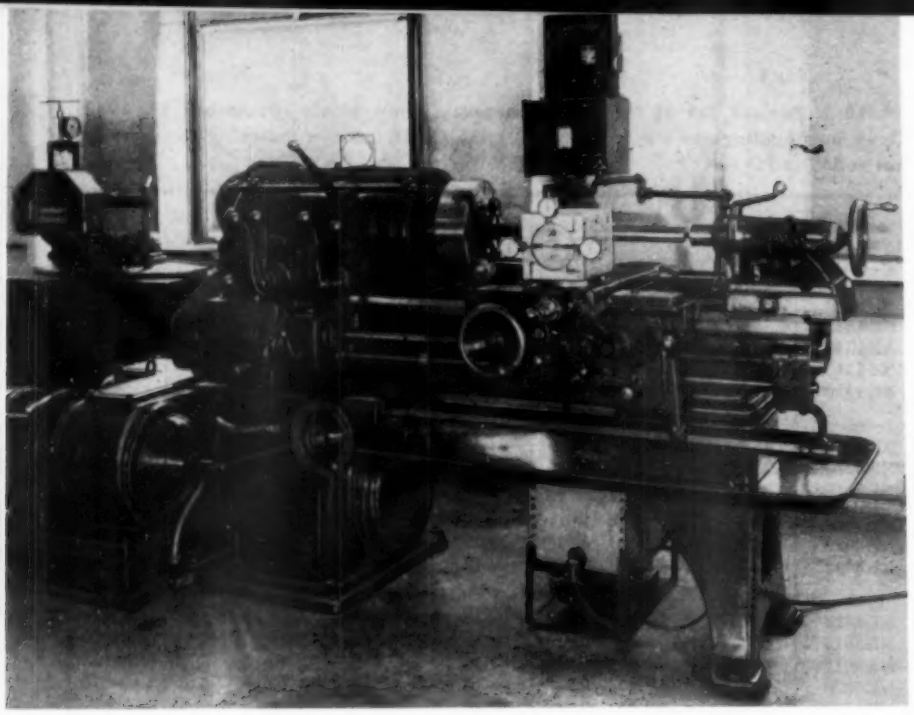
TABLE 1. Revised list of National Emergency Alloy Steels (December 17, 1942). Open hearth, alloy and electric furnace alloy steels (blooms, billets, slabs, bars and hot rolled strip).

Designation	C	Mn	P Max.*	S Max.*	Si	Ni	Cr	Mo
				Carbon-Manganese Steels				
NE 1330	0.28-0.33	1.60-1.90	0.040	0.040	0.20-0.35			
NE 1335	0.33-0.38	1.60-1.90	0.040	0.040	0.20-0.35			
NE 1340	0.38-0.43	1.60-1.90	0.040	0.040	0.20-0.35			
NE 1345	0.43-0.48	1.60-1.90	0.040	0.040	0.20-0.35			
NE 1350	0.48-0.53	1.60-1.90	0.040	0.040	0.20-0.35			
				Carbon-Chromium Steels				
NE 52100*C*	0.95-1.10	0.25-0.45	0.025†	0.025†	0.20-0.35	0.35 max.	0.40-0.60	0.08 max.
NE 52100*B*	0.95-1.10	0.25-0.45	0.025†	0.025†	0.20-0.35	0.35 max.	0.90-1.15	0.08 max.
NE 52100*A*	0.95-1.10	0.25-0.45	0.025†	0.025†	0.20-0.35	0.35 max.	1.30-1.60	0.08 max.
				Manganese-Molybdenum Steels				
NE 8020	0.18-0.23	1.00-1.30	0.040	0.040	0.20-0.35			0.10-0.20
NE 8442‡	0.40-0.45	1.30-1.60	0.040	0.040	0.20-0.35			0.30-0.40
				Nickel-Chromium-Molybdenum Steels				
NE 8613	0.12-0.17	0.70-0.90	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8615	0.13-0.18	0.70-0.90	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8617	0.15-0.20	0.70-0.90	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8620	0.18-0.23	0.70-0.90	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8630	0.28-0.33	0.70-0.90	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8635	0.33-0.38	0.75-1.00	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8637	0.35-0.40	0.75-1.00	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8640	0.38-0.43	0.75-1.00	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8642	0.40-0.45	0.75-1.00	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8645	0.43-0.48	0.75-1.00	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8650	0.48-0.53	0.75-1.00	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.15-0.25
NE 8720	0.18-0.23	0.70-0.90	0.040	0.040	0.20-0.35	0.40-0.70	0.40-0.60	0.20-0.30
				Silicon-Manganese and Silicon-Manganese-Chromium Steels				
NE 9255	0.50-0.60	0.70-0.95	0.040	0.040	1.80-2.20			
NE 9260	0.55-0.65	0.75-1.00	0.040	0.040	1.80-2.20			
NE 9262	0.55-0.65	0.75-1.00	0.040	0.040	1.80-2.20		0.20-0.40	
				Manganese-Silicon-Chromium-Nickel-Molybdenum Steels				
NE 9415	0.13-0.18	0.80-1.10	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9420	0.18-0.23	0.80-1.10	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9422	0.20-0.25	0.80-1.10	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9430	0.28-0.33	0.90-1.20	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9435	0.33-0.38	0.90-1.20	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9437	0.35-0.40	0.90-1.20	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9440	0.38-0.43	0.90-1.20	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9442	0.40-0.45	1.00-1.30	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9445	0.43-0.48	1.00-1.30	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9450	0.48-0.53	1.20-1.50	0.040	0.040	0.40-0.60	0.20-0.50	0.20-0.40	0.08-0.15
NE 9537‡	0.35-0.40	1.20-1.50	0.040	0.040	0.40-0.60	0.40-0.70	0.40-0.60	0.15-0.25
NE 9540‡	0.38-0.43	1.20-1.50	0.040	0.040	0.40-0.60	0.40-0.70	0.40-0.60	0.15-0.25
NE 9542‡	0.40-0.45	1.20-1.50	0.040	0.040	0.40-0.60	0.40-0.70	0.40-0.60	0.15-0.25
NE 9550‡	0.48-0.53	1.20-1.50	0.040	0.040	0.40-0.60	0.40-0.70	0.40-0.60	0.15-0.25
				Manganese-Silicon-Chromium Steels				
NE 9630	0.28-0.33	1.20-1.50	0.040	0.040	0.40-0.60		0.40-0.60	
NE 9635	0.33-0.38	1.20-1.50	0.040	0.040	0.40-0.60		0.40-0.60	
NE 9637	0.35-0.40	1.20-1.50	0.040	0.040	0.40-0.60		0.40-0.60	
NE 9640	0.38-0.43	1.20-1.50	0.040	0.040	0.40-0.60		0.40-0.60	
NE 9642	0.40-0.45	1.30-1.60	0.040	0.040	0.40-0.60		0.40-0.60	
NE 9645	0.43-0.48	1.30-1.60	0.040	0.040	0.40-0.60		0.40-0.60	
NE 9650	0.48-0.53	1.30-1.60	0.040	0.040	0.40-0.60		0.40-0.60	

*These limits are for basic open hearth steel. Lowest standard maximum phosphorus or sulphur content for acid open hearth or acid electric furnace alloy steel is .05% each.

†These limits are for electric furnace grades; if made in the basic open hearth, the sulphur and phosphorus may be .04% max. each.

‡For large sections only.



Engine lathe for machinability tests in the metal processing laboratory at the University of Michigan. This Monarch 16-speed, geared-head, 14-inch by 8-foot lathe is driven by a 10-horsepower, constant-speed motor connected to a Reeves Vari-speed Motodrive.

A mechanical three-component cutting force dynamometer is shown mounted on the carriage, a cutting fluid tank for circulating temperature controlled cutting fluids in any quantity is shown below the lathe, and a stop watch is shown on the headstock.

A hydraulic recording type three-component dynamometer is shown at the rear left. This equipment is used in studying the cutting properties of metals, cutting fluids or tools. Accurate control of speed is necessary.

between the SAE 4620 and the substituted NE 8620 steel. The steel in both cases was machined in an annealed condition in which a Brinell hardness range of 143 to 163 was obtained with a blocky type structure of pearlite and ferrite.

The finishing operation on this gear was done on an eight-inch manufacturing type Gleason generator, using 420 cutter strokes per minute and a feed of 4.7 seconds per tooth. From 0.026-inch to 0.030-inch of stock was removed from each side of the tooth to a depth of 0.370-inch. Approximately 60 to 70 pieces were obtained per grind of the cutters. Practically no difference in machining results was noted between that of the high alloy SAE 4620 steel and the new NE 8620 steel.

The same company reported that in roughing a 39-tooth spiral bevel ring gear on a 15-inch Gleason generating machine with a feed of 19 seconds per tooth and a cutter speed of 119 fpm, that from 25 to 30 pieces per grind of the cutters were obtained on the SAE 4620 steel and from 20 to 25 percent more parts from the NE 8620 steels annealed to the same hardness of 143 to 163 Brinell to give a blocky type structure of pearlite and ferrite.

The above gear was finished on a 15-inch Gleason spiral bevel gear generator using a feed of 42 seconds per tooth and a cutter speed of 139 fpm. Approximately 0.030-inch of stock was removed from each side of the teeth to a total depth of 0.552-inch. Approximately 20 to 25 pieces were produced per grind of the cutter. In several cases an improvement in finish and uniformity of bearing position was shown on the NE steel.

Another case reported by a large motor company engaged in war work involved the substitution of NE 8620 steel for an SAE 4620 steel formerly used. The material in both instances was cycle annealed to give a Brinell hardness of 179 to 207. The part machined was four-inches in diameter. Molybdenum high speed steel tools of the Mo-Tung type were used which were ½-inch wide by one-inch height of a form of 12° back rake, 6° side rake, 6° end and side relief, 13° end cutting edge angle, 0° side cutting edge angle, and ⅛-inch nose radius. An emulsion of one part soluble oil mixed with 34 parts of water flowed fully on the work and tools. The cutting speed in rough turning was 90 fpm and for finishing turning 120 fpm. The feed for both steels was 0.012-inch per revolution, and the depth was 3/32-inch for a ⅞-inch wide facing cut. In this substitution no change in machinability characteristics was noted.

A tractor company reported that NE 8620 steel served as an excellent alternate for SAE 4615 and 4620 steel, and that the machinability was equally good.

NE 8720 for SAE 4820

A large gear manufacturer reported that in substituting NE 8720 steel for SAE 4820 steel for a spiral bevel differential drive pinion, 80 pieces per cutter grind were obtained in both instances. Both materials were annealed to give a blocky type of structure of pearlite and ferrite and a Brinell hardness ranging from 143 to 163. The work was done on a 15-inch Gleason generator with a feed of 29 seconds per tooth and a cutter speed of 157 fpm. The point width of the cutter at the bottom of cut was 0.060-inch and at the top 0.525-inch. The total depth of cut was 0.560-inch and the tooth face length was 1.625-inch.

Again, in finishing this gear on a 15-inch spiral bevel gear generator, using a feed of 44 seconds per tooth and a cutter speed of 139 fpm, the machinability results were found to be approximately the same. About 0.030-inch of stock was removed from each side of the tooth to a total depth of 0.552-inch. From 135 to 140 pieces were produced per cutter grind.

NE 8720 for SAE 4815

The large automotive company engaged in war work substituted NE 8720 steel for SAE 4815 steel. The part 3¾-inch in diameter was cycle annealed to give a Brinell hardness of 179 to 207. Mo-Tung type of high speed steel tools were used, ½-inch wide by one-inch in height, of 12° back rake, 6° side rake, 6° end and side relief, 13° end cutting edge angle, 0° side cutting edge angle, and ⅛-inch nose radius. An emulsion of one to 34 flowed fully on the work and tools. Rough turning was done at 90 fpm on both steels and finish turning was done at 120 fpm with a feed of 0.012-inch per revolution in

each case. A facing cut had a depth of 5/32 inch for a radial distance of 15/16 inch. There was a considerable improvement in machinability of NE 8720 steel over that of the SAE 4815 steel, inasmuch as 65 parts were produced per grind for the SAE steel while 85 parts per grind were obtained for the NE steel.

NE 8720 for SAE 4620

A gear and axle manufacturer reported that an NE 8720 steel replaced SAE 4620 steel for a large gear blank 12-inch in diameter and 1½-inch thick. The material was normalized to give a Brinell hardness of 163. Double 6 molybdenum high speed steel tools were used after being hand ground. A stream of soluble oil was poured on the tool. Turning was done at 178 fpm with a depth of cut of 0.125-inch and a feed of 0.010-inch. Sixty pieces were obtained per tool grind. This value conforms favorably with that obtained on the SAE 4620 steel which was replaced. It was concluded that in turning and milling the steel in a normalized condition the NE 8720 compares favorably with the SAE 4620 steel.

NE 8724 for SAE 4820

A tractor company employed NE 8724 as an alternate for SAE 4820 (high Ni-Mo). The molybdenum was preferably near the maximum of 0.30 per cent to give the same penetration of hardness and good core properties of heavy-sectioned gear teeth. The annealed hardness of NE 8724 was from 143 to 173 Brinell, but if lower than 156 the machinability became poor, that is, poor surface finish resulted on the gear teeth produced on Gleason and Fellows shapers. In the range of 163-187 Brinell, the machinability was found to be superior to that of the SAE 4820 steel.

NE 8744 for SAE 3240

A gear and axle company reported that the machinability of NE 8744 and NE 8944 steels when normalized compared favorably with SAE 3240 and 4340 in turning and milling operations. Further, that in the oil-quenched at 1550° F and tempered at 700° F state, NE 8744 gives approximately 60 percent of the tool life of SAE 3240 and SAE 4340, at the corresponding hardness of 370 to 430 Brinell.

NE 8949 for SAE 4345

A milling machine manufacturer recently milled SAE 4345 and NE 8949 steels with a spiral mill under identical conditions. The two alloy steels have approximately equal depth hardening properties, yet they differ widely as to composition. On the basis of hardenability rating, the two steels should have exhibited approximately equal cutting performance, but this was not the case, since NE 8949 required more power and gave a poorer surface finish than the SAE 4345 which exhibited excellent cutting reactions.

The NE 9200 series of steels should be annealed for machining. Their general rating based on that of Bessemer screw stock is approximately 45 per cent when annealed to a hardness of from 187 to 255.

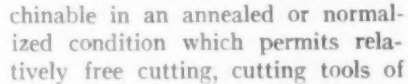
SAE 9250

The relative machinability of SAE 9250 steel compared with 15 other steels is shown in Table 2. All steels were forgings two-inches by 4-inches in section, then normalized and annealed. The Brinell hardness of each is given along with the constants for the torque and thrust formulas obtained in drilling them with standard twist drills under a flow of an emulsion of one to 16. The drill diameter in inches is d, and the feed in ipr is f. The ratings can be represented by the values of "C" or "K". For the SAE 9250 steel, C equals 1800 which is close to that for the SAE 6150 (Cr-Va), 3250 (Cr-Ni), 2340 (3½% Ni), and 2330 steel. A number of the steels such as the lower carbon (Cr-Va) steels 6120, 6130, 6140, and the higher carbon steel 1095 have higher values.

NE 9400 Series

The NE 9400 series (manganese-silicon - chromium - nickel - molybdenum) are as yet too new and reports to date are not sufficient to permit anything but an estimate as to their machinability. The following data were submitted by a steel company engaged in cold finishing steel:

Grade	Approx. Machine Rating	Approx. Turning Speed	Character of Machined Chip
As-Rolled — Cold Drawn			
NE-9415	55%	100 SFM	Continuous and hard
NE-9420	55%	100 SFM	Continuous and hard
NE-9422	53%	95 SFM	Continuous and springy
As-Annealed — Cold Drawn			
NE-9430	64%	115 SFM	Continuous and semi-hard
NE-9435	60%	110 SFM	Continuous and semi-hard
NE-9437	60%	110 SFM	Continuous and semi-hard
NE-9440	58%	105 SFM	Continuous and hard
NE-9442	53%	95 SFM	Continuous and tough
NE-9445	47%	85 SFM	Continuous and tough
NE-9450	45%	80 SFM	Continuous and tough



Turning tool design

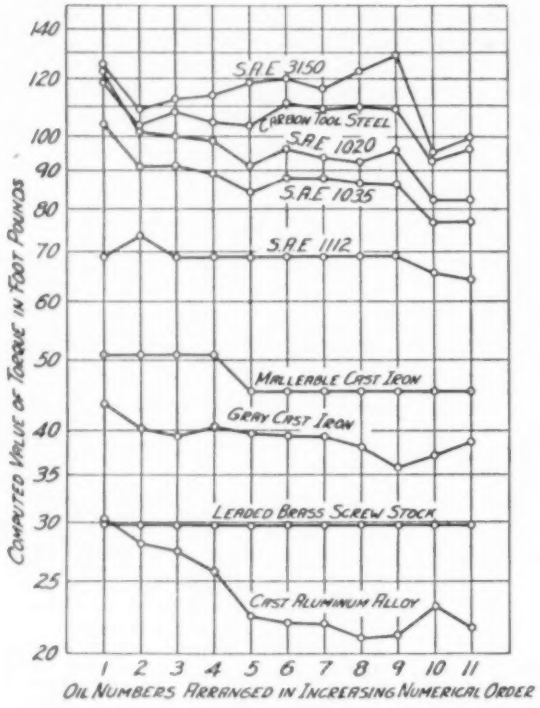
As most of the NE steels are machinable in an annealed or normalized condition which permits relatively free cutting, cutting tools of high speed steel are adequate. Regardless of the composition of the tool steel, a shape of turning tool appropriate for this work would be as

TABLE 2. The values of the constants C for Torque in pounds-feet and K for Thrust in pounds for several analyses of steel in the form of forgings, normalized and annealed.

These constants represent the relative machinability of these steels under these conditions of being drilled when an emulsion of one part soluble oil to sixteen parts of water.

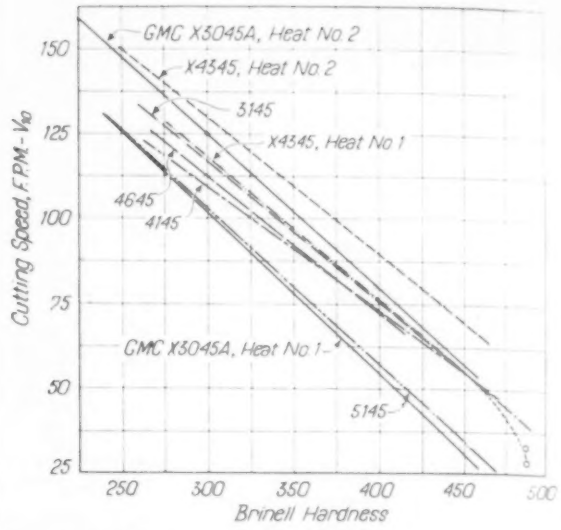
T (torque) $= Cf^{0.78}\, d^{1.8}$. B (thrust) $= Kf^{0.78}\, d$.

SAE No.	Brinell	C	K
1020	137	1,590	40,000
1045	159	1,590	42,000
1095	154	2,180	69,000
2320	163	1,510	44,000
2330	202	1,780	66,000
2340	207	1,840	65,000
3120	143	1,510	39,000
3135	192	1,500	46,000
3250	207	1,740	57,000
3140	196	1,550	50,000
4130	156	1,560	43,000
6120	137	2,100	55,000
6130	156	2,000	56,000
6140	163	2,000	56,000
6150	187	1,840	53,400
9250	202	1,800	63,000



Machinability rating as expressed by torque in pounds-feet on a drill will vary for any metal in accordance with the type of cutting fluid used. Above values of torque are given for various metals by a 1¼-inch diameter drill operating at .015-inch feed when cutting at 60 fpm. The cutting fluids are listed below. It is seen that the torque varies differently for each metal; some cutting fluids cause a reduction in torque over dry cutting, while others may cause an increase, as in the case of SAE 1112 steel, malleable cast iron, and leaded brass screw stock, they exert no influence whatever.

1. Dry cutting
2. Water containing 1½ percent borax
3. 1 part soluble oil to 50 parts water
4. 1 part soluble oil to 10 parts water
5. A No. 2 lard oil
6. A light mineral oil
7. A heavy mineral oil
8. A light mineral oil containing 10 percent lard oil
9. A light mineral oil containing 5 percent oleic acid
10. A sulpherized mineral oil
11. A sulpherized lard-mineral oil



Machinability ratings expressed as V_{10} for several alloy steels of the SAE high alloy type for various values of Brinell hardness. The depth of cut was .050-inch, the feed .0127-inch, and a 1 to 20 emulsion was used. The tool had the shape recommended in this article on NE steels. This shows that the cutting speed is inversely proportional to the hardness. Most of the steels have machinability ratings nearly equal for the higher hardnesses.

Beginning on page 93: An article relating the selection of cutting fluids to the machinability of metals.

follows: 8° back rake, 14° side rake, 6° end relief, 6° side relief, 6° end cutting edge angle, and 15° side cutting edge angle. The nose radius should be large, but not in excess of 10-20 percent of the depth of cut to be used. If cemented carbide tools are used, a back rake angle of from 0 to -5° may be used, a side rake angle of from 5° to 10°, side and end relief of 5°, an end cutting edge angle of 6°, a side cutting edge angle of from 0° to 15°, nose radius of 1/32-inch.

In general, standard drills and milling cutters can be used with rake angles from 10° to 15° on the milling cutters. In threading, a rake of from 10° to 15° will give good results with the chip space or flute ground smooth and to a full radius.

Cutting fluids

In general, emulsions of soluble oils are satisfactory for turning, milling, and drilling, and those operations employing relatively high cutting speeds. For low cutting speeds as used in broaching, reaming, and threading, sulphurized mineral oils should be used. A mixture of mineral oil plus from 10 percent to 15 percent fatty oil serves as a good substitute for the sulphurized mineral oil.

Cutting fluids should be applied at low temperature in large quantity and at high velocity in order to be most effective.

It may be stated that the machinability of the current National Emergency steels corresponds favorably with that of the AISI or SAE steels replaced if at the same hardness. It must be remembered that "machinability" is a broad term and may refer to anyone of several features of the metal cutting operation, such as long tool life, well-broken-up chips, good surface quality, and low power consumption. Further, the machinability may be a function of the metal cutting process so that for broaching, for example, the rating of a steel must be based on surface quality, dimensional accuracy, and chip formation as taking precedence over tool life. In many operations such as gear cutting, form turning, or threading, finish in itself is more important than tool life. Chip formation in many instances such as in automatic screw machines and turning machines may be of primary importance because of the difficulty in disposing of long continuous chips which may mar the machined surface of the work or may become involved with the tools and spindles of the machine. Tool angles, cutting speeds, and ratio between depth of cut and feed will have to be adjusted in order to produce the most favorable results required for each job.

THE END.

Machinability Ratings of Metal and Cutting Fluid Recommendations

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THE machinability rating chart, Table A, is based upon the 100 percent rating of AISI Steel Specifications B-1112, cold rolled or cold drawn, when machined with a suitable cutting fluid at 180 feet per minute under normal cutting conditions. The ratings are based on steels in a cold drawn condition. Metals that have been heat treated or processed in any way other than cold drawn will, of course, have different machinability ratings.

Machinability ratings have been given values to the nearest five percent. The metals have been classified to facilitate the drawing up of the cutting fluid chart. It is important to note that because of favorable price differentials, many users prefer hot rolled steels for many purposes. The relative effect of hot rolling may be expressed briefly as follows:

(a) In steels containing up to 0.30 percent carbon, cold rolled or cold drawn bars have better machinability than hot rolled bars.
(b) In steels containing from 0.30 percent to 0.40 percent carbon, there is little difference in machinability between cold rolled and hot rolled bars.
(c) In steels containing over 0.40 percent carbon, the hot rolled material has superior machinability over cold rolled or cold drawn. It is recommended that plain carbon steels over 0.40 percent carbon and alloy steels over 0.30 percent carbon be annealed for machining.

The range of Brinell hardness values for each of the ferrous materials is intended to provide the most desirable limits for normal machinability ratings, and, in general, describes the commercial practise in filling steel purchase orders. Generally, the limiting value of hardness for normal machinability is considered to be 355 Brinell although many steels are now being machined in mass production at hardness of 400 Brinell and higher.

A similar classification has been given to machining operations, arranging them in order of their severity, for example: The most severe operation, Number 1, Table B, is internal broaching, and the easiest, Number 10, is sawing. The final table indicates the severity of the operation, and the cutting fluid recommendation for each metal classification. Users of this table may find helpful the following general notes on cutting fluid selection.

•To simplify a table of recommendations which can be used to apply cutting fluids to various processes, involving different metals, the metals are first listed in groups in accordance with their machinability ratings. A wide variety of ferrous and non-ferrous metals have been rated individually and then arranged in six classes as follows:

Ferrous Metals as compared with AISI B 1112 Cold Drawn

Class 1	70% or over
Class 2	50 to 75%
Class 3	40 to 50%
Class 4	below 40%

Non-ferrous Metals compared with AISI B 1112 Cold Drawn

Class 5	100% or over
Class 6	below 100%

CUTTING FLUID SELECTION

1. **Cutting fluid selection** should be based on the individual operation, material being machined, tool material, size and shape, and the conditions of operation, such as speed, depth of cut and feed, and results desired in tool life, chip formation and finish. Preferred recommendations in bold italics in Table B are intended to serve only as a guide to the choice of a cutting fluid.

2. **This report** correlates recommendations from general use and practice together with suggestions for each specific cutting problem such as milling A-3140 steel in its annealed condition. These recommendations represent the average practice of the majority of users of cutting fluids when normal operating conditions are maintained.

3. **Proper cutting fluid** determination for normal operating conditions may be obtained by referring to the table. For example, a normal milling operation, where the operating condition is within the limits specified by the manufacturer of the machine and the steel, will come under the classification as given in the table. However, if a deeper cut, higher cutting speed, or heavier feed are desired, it will become necessary for the user to be guided by the recommendation for a more severe operation.

4. **Types of fluids,** rather than products of individual companies, are recommended in Table B. In the purchase of such fluids, there may be a difference in effectiveness between two fluids of the same type on a given machine operation owing to different manufacturing techniques of the producers.

5. **Further break down** of this classification might be more specific. However, the analysis would become bulky and unwieldy. In many instances,

NOTE: Since 1940, when the first report of The Independent Research Committee on Cutting Fluids was presented, comments have been solicited regarding its accuracy and to determine whether additions could be made. Accuracy has been substantiated by general acceptance, and by the fact that no corrections of major import have been received for either the machinability tables or the cutting oil reference guide. However, this paper, a revision of the original, presents up-to-date ratings, selection of fluids and nomenclature. The revision was the work of the authors noted above and M. A. Dixon, Standard Oil of Indiana.

such a list of recommendations would be difficult for the lay user of cutting oils to interpret.

6. Mineral-lard oil and sulfurized oil mixtures of low sulfur percentage are interchangeable, generally speaking.

7. Sulfurized oils have a tendency to stain certain non-ferrous metals, such as copper and its alloys.

8. Carbon tetrachloride, chloroform and certain other volatile solvents should not be added to cutting fluids as harmful physiological effects might follow.

9. In machining aluminum, quite often cutting oils are diluted with kerosene or mineral seal oil with satisfactory results. Kerosene, up to 15 percent, is frequently added to emulsions to improve the surface quality of machined aluminum.

10. Magnesium and its alloys are usually machined with mineral seal oil except where it is desirable to machine dry. A supply of powdered asbestos should be kept handy to smother a fire. Tools should be kept sharp and heavy feeds used. Chips should not be permitted to accumulate in the machine.

11. In machining brass, which shows no change in cutting pressures with various cutting fluids, it is advisable to apply a cutting fluid to function as a coolant. Inasmuch as most free-cutting brass is machined in auto-

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TABLE A. Machinability Rating of Various Ferrous and Non-Ferrous Metals of Six Class Groups

Each metal is rated to the nearest 5% based on the 100% rating of AISI steel specification B 1112, cold rolled or cold drawn, when machined with a suitable cutting fluid at 180 feet per minute under normal cutting conditions.

NOTE: The terms "annealed" and "spheroidized anneal" refer specifically to the commercial practice in steel mills, prior to cold drawing or cold rolling, in the production of the steels specifically mentioned.

*=Annealed. **=Spheroidized Anneal.

PREFIX LETTER DESIGNATIONS

C —Denotes basic open hearth carbon steel.
B —Denotes acid Bessemer carbon steel.
CB—Denotes either acid Bessemer or basic open hearth carbon steel at the option of the manufacturer.
A —Denotes basic open hearth alloy steels.
E —Denotes electric furnace steels of both carbon and alloy types.
NE—Denotes the National Emergency series of steels.

CLASS NUMBER 1

Ferrous (70% and higher)

A.I.S.I.	RATING %	BRINELL
C 1110	85	137—166
C 1115	85	143—179
C 1117	85	143—179
C 1118	80	143—179
C 1120	80	143—179
C 1132	75	187—229
C 1137	70	187—229
C 1022	70	159—192
C 1016	70	137—174
B 1111	95	179—229
B 1112	100	179—229
B 1113	135	179—229
A 4023	70	156—207
A 4027*	70	166—212
A 4119	70	170—217
Mall-Iron (Ferritic)	100—250	120—200
Mall-Iron (Pearlitic)	70	190—240
Cast Steel (0.35%C)	70	170—212
Stainless Iron (Free Cutting)	70	163—207

CLASS NUMBER 2

Ferrous (50% to 65%)

A.I.S.I.	RATING %	BRINELL
C 1141	65	183—241
C 1020	65	137—174
C 1030	65	170—212
C 1035	65	174—217
C 1040*	60	179—229
C 1045*	60	179—229
A 2317	55	174—217
A 3045*	60	179—229
A 3120	60	163—207
A 3130*	55	179—217
A 3140*	55	187—229
A 3145*	50	187—235
A 4032*	65	170—229
A 4037*	65	179—229
A 4042*	60	183—235
A 4047*	55	183—235
A 4130*	65	187—229
A 4137*	60	187—229
A 4145*	55	187—229
A 4150*	50	187—235
A 4615	65	174—217
A 4640*	55	187—235
A 4815	50	187—229
A 5120	65	170—212
A 5140*	60	174—229
A 5150*	55	179—235
A 5045*	65	179—229
NE 8024	60	174—217
NE 8124	55	174—217
NE 8233*	60	179—229
NE 8339*	60	179—229
NE 8620	60	170—217
NE 8630*	65	179—229
NE 8724	65	179—229
NE 8739*	60	179—229
NE 8744*	55	183—235
NE 8749*	50	183—241
NE 8817	60	170—229

CLASS NUMBER 3

Ferrous (40% to 50%)

A.I.S.I.	RATING %	BRINELL
C 1008	50	126—163
C 1010	50	131—170
C 1015	50	131—170
C 1050*	50	179—229
C 1070*	45	183—241
A 1320	50	170—229
A 1330*	50	179—235
A 1335*	50	179—235
A 1340*	45	179—235
A 2330*	50	179—229
A 2340*	45	179—235
A 3240*	45	183—235
A 4340*	45	187—241
A 6120	50	179—217
A 6145*	50	179—235
A 6152**	45	183—241
A 9260*	45	187—255
NE 8442*	45	187—255
NE 8447*	40	187—255
NE 8949*	50	187—255
Ingot Iron	50	101—131
Wrought Iron	50	101—131
Stainless 18-8 F.M.	45	179—212
Cast iron	50	160—193

CLASS NUMBER 4

Ferrous (40% and below)

A.I.S.I.	RATING %	BRINELL
A 2515*	30	179—229
E 3310*	40	170—229
E 52100**	30	183—229
Ni-Resist*	30	
Stainless 18-8 (Austenitic)*	25	
Manganese oil hardening steel**	30	
Tool steel, low tungsten, chromium and carbon**	30	
High-speed steel**	30	
High carbon-high chrome tool steel**	25	

CLASS NUMBER 5

Non-ferrous (above 100%)

A.I.S.I.	RATING %
Magnesium Alloys	500—2000
Aluminum 11-S	500—2000
Aluminum 2-S	300—1500
Aluminum 17-S	300—1500
Brass, Leaded F. C. C. D.	150—600
Brass, Yellow	200
Brass, Red	200
Bronze, Lead Bearing	200—500
Zinc	200

CLASS NUMBER 6

Non-ferrous (below 100%)

A.I.S.I.	RATING %
Gun Metal	60
Bronze, Manganese	40
Copper, Cast	70
Copper, Rolled	60
Nickel	20
Monel Metal, Cast	35
Monel Metal, Rolled	45
Monel Metal, "K"	50
Inconel	45
Everdur	60

TABLE B. Cutting fluid recommendations for various machining operations for each of six groups of metals based upon normal operating speeds, tool life, and finish.

TYPE OF OPERATION	GROUPS OF METALS BASED ON CLASS OF MACHINABILITY RATINGS																				
SEVERITY: 1=Greatest 10=Least	1. FERROUS, OVER 70%			2. FERROUS, 50 - 70%			3. FERROUS, 40 - 50%			4. FERROUS, BELOW 40%			5. NON-FERROUS, OVER 100%			6. NON-FERROUS, BELOW 100%		
1. Broaching - Internal	Em.	Sulf. (a)		Sulf.	(b) Em.		***Sulf.***	Em.		***Sulf.***	Em.		MO.	Em.		Sulf.	ML.	
2. Broaching - Surface	Em.	Sulf.		***Em.***	Sulf.		***Sulf.***	Em.		***Sulf.***	Em.		MO.	Em.		Sulf.	ML.	
3. Tapping - Plain	Sulf.			Sulf.			Sulf.			Sulf.			Em.	Dry		Sulf.	ML.	
2. Threading - Pipe	Sulf.			***Sulf.***	ML.		Sulf.			Sulf.						Sulf.	(c)	
3. Threading - Plain	Sulf.			Sulf.			Sulf.			Sulf.			Em.	Sulf.		Sulf.		
4. Gear Shaving	Sulf.	L.		Sulf.	L.		Sulf.	L.		Sulf.	L.							
4. Reaming - Plain	ML.	Sulf.		ML.	Sulf.		ML.	Sulf.		ML.	Sulf.		ML.	MO.	Em.	ML.	MO.	Sulf.
4. Gear Cutting (d)	Sulf.	ML.	Em.	Sulf.			Sulf.			Sulf.	ML.					Sulf.	ML.	
5. Drilling - Deep	***Em.***	ML.		Sulf.	***Em.***		Sulf.			Sulf.			MO.	ML.	Em.	Sulf.	ML.	
6. Milling - Plain	***Em.***	ML.	Sulf.	Em.			Em.			Sulf.			Em.	MO.	Dry	Sulf.	Em.	
6. Milling - Multiple Cutter	ML.			Sulf.			Sulf.			***Sulf.***	ML.		Em.	MO.	Dry	***Sulf.***	Em.	
7. Boring - Multiple Head	***Sulf.***	Em.		***Sulf.***	Em.		***Sulf.***	Em.		Sulf.	Em.		K.	Dry	Em.	Sulf.	Em.	
7. Multiple Spindle Automatic Screw Machines & Turret Lathes - Drilling, Forming, Turning, Reaming, Cutting Off, Tapping, Threading	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	ML.	Em.	Em.	Dry	ML.	Sulf.		
8. High Speed, Light Feed Automatic Screw Machines - Drilling, Forming, Tapping, Threading, Turning, Reaming, Box Milling, Cutting Off	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	ML.	Em.	Em.	Dry	ML.	Sulf.		
9. Drilling	Em.			Em.			Em.			Em.	Sulf.		Em.	Dry		Em.		
9. Planing, Shaping	***Em.***	Sulf.	ML.	***Em.***	Sulf.	ML.	Sulf.	***Em.***		***Em.***	Sulf.		Em.	Dry		Em.		
9. Turning - Single Point Tool Form Tools	Em.	Sulf.	ML.	Em.	Sulf.	ML.	Em.	Sulf.	ML.	Em.	Sulf.	ML.	Em.	Dry	ML.	Em.	Sulf.	
10. Sawing— Circular, Hack	Sulf.	ML.	Em.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Dry	MO.	Em.	Sulf.	Em.	ML.
Grinding— (a) Plain	Em.			Em.			Em.			Em.			Em.			Em.		
(b) Form (Thread, etc.)		Sulf.			Sulf.			Sulf.			Sulf.			MO.	Sulf.		Sulf.	

SYMBOLS FOR CUTTING FLUIDS

K—Kerosene
L—Lard Oil
MO—Mineral Oils
ML—Mineral - Lard Oil
SULF—Sulfurized Oils (see note "A")
Em—Soluble or Emulsifiable Oils and Compounds
DRY—No Cutting Fluid

NOTES:

a) Oils containing both sulfur and chlorine when carefully manufactured and sponsored may be used where sulfurized oils are indicated.

b) Preferred recommendations are underlined.

c) In threading copper, palm oil is frequently used.

d) It has been reported by several observers that emulsions are usually unsatisfactory on some precision machine tools such as Fellows Gear Shapers and Gleason Gear Generators.

matic screw machines an oil is advisable to lubricate the moving parts of the machine. A paraffin or light mineral oil may suffice, or the mineral oil blended with 10 percent fatty oil may be used to advantage.

12. In turning Monel Metal, it has been found that an emulsion gives a slightly longer tool life than a sulfurized mineral oil. However, the latter produces broken up chips which in many instances is desirable.

13. In general, cutting fluids should be applied in large quantities at the highest velocity possible without splashing, directly onto the tool point where the chip is being formed. From three to five gallons for each single point tool is most effective; particularly when carbide tools are used the cutting fluid should flood the tool before the start of the cut and be applied continuously during the cut. Rapid change in temperature is injurious to most tools. The use of sulfurized oils on carbide tools is reported to be injurious to the tools.

14. Keep cutting fluids cool, either through the use of sufficient volume or through cooling agencies. For satisfactory tool life, temperature of the cutting fluid should not be permitted to exceed 110°.

15. Keep cutting fluids clean—free from suspended chips, bacteria and high acidity.

16. On complicated machines, oils should be used where parts such as tool slides, must be lubricated. On some jobs, such as milling and drilling, lubrication of the chips in the flutes or chip space is an important factor in chip removal.

17. On high-speed operations, cooling is more important than lubrication, inasmuch as the speed itself usually provides good surface quality. On low speeds where the segmental or discontinuous type of chip is formed, the face of the tool may be periodically lubricated so that oils, and particularly a sulfurized oil for threading and broaching, are desirable.

THE END

Highlight of the 11th Annual Meeting of the A.S.T.E. was the selection of national officers for 1943-1944. *Above (l. to r.)* Ray H. Morris, President, is Vice President of Hardinge Brothers, Inc., Hartford; Douglas Burnside, First Vice President, is Superintendent, Quick Meal Stove Co. Division, American Stove Co., St. Louis; C. V. Briner, Second Vice President, is Sales Manager, The Pipe Machinery Co., Cleveland; Earl Johnson, Secretary, is Production Specialist, Firth-Sterling Steel Co., Dayton. *At right:* Floyd Eaton, Treasurer, who was unable to attend due to responsibilities in the War Manpower Commission, Detroit.

CAMERA HIGHLIGHTS

American Society of Tool Engineers Convenes at Milwaukee for Annual Meeting

Left: Among the speakers, *left to right:* Chairman J. B. Gilbert, Ampco Metal; Dr. B. I. Beverly, Republic Drill & Tool Co.; W. A. Simonds, Willow Run; J. I. Onarheim, Allis-Chalmers Mfg. Co.

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Below: Retiring National officers at Directors luncheon. *(L. to r.)* Frank Crone; Ray Morris; Otto Winter; Clyde Hause; Doug Burnside.

Photos by The Bramson Publishing Company

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Below: 25 directors were closeted for 15 hours the first day, dined in this banquet room in Milwaukee's Hotel Schroeder.

Directors laughed when President Ray Morris was served a bottle of milk by Vice President Doug Burnside and a Tool Engineer Editor. Frank Curtis is in background.

The man who sold Philadelphia for 1944, P. W. Frankfurter, argued "We can get you anything in Philadelphia that you can get in New York." His fellow directors agreed.

Above: W. R. Breeler, Dunkirk, N. Y., receives member's badge from Mary Silverman.

Below: Representatives from coast to coast. *(L. to r.):* L. M. Cole, Houston; K. Bues, Oakland; O. Winter, Detroit; W. F. Asmus, San Diego.

PRODUCTION DATA SHEET

MACHINING ALUMINUM

Facts and figures on machining aluminum have become tremendously important with increased production of war material. Throughout the months of war and preparation, THE TOOL ENGINEER has presented detailed articles on various machining operations involving aluminum. However, readers have asked for more information on speeds and feeds. These tables should do much to answer their questions.

These data are reprinted from "Machining Alcoa Aluminum," a copyrighted booklet published by Aluminum Company of America.

TABLE 1—COMMERCIAL ALUMINUM ALLOYS

Type*	Alloy	COMPOSITION (per cent) Cu	Fe or Mn	Si	Mg	Other
Non-Heat-Treated Casting Alloys						
I	173	7.0	.....	...	...	2.0 Sn
	C113	7.5	1.2 Fe	4.0	...	2.0 Zn
	645	2.5	1.5 Fe	...	...	11.0 Zn
	B113	7.5	1.2 Fe	2.8	...	.....
II	112	7.5	1.2 Fe	...	...	2.0 Zn
	216	....	.....	...	6.0	.....
	A214	....	.....	...	3.8	2.0 Zn
	109	12.0	.....	...	...	.....
	12	8.0	.....	...	...	.....
	214	....	.....	...	3.8	.....
	212	8.0	1.0 Fe	1.2	...	.....
	B214	....	.....	1.8	3.8	.....
III	172	7.8	.....	2.5	...	.....
	A108	4.5	.....	5.5	...	.....
	108	4.0	.....	3.0	...	.....
	356	....	.....	7.0	0.3	.....
	43	....	.....	5.0	...	.....
Heat-Treated Casting Alloys (a)						
I	220(b)	....	.....	...	10.0	.....
II	122	10.0	1.2 Fe	...	0.2	.....
	D195	5.5	.....	0.7	...	.....
	142	4.0	.....	...	1.5	2.0 Ni
	195	4.0	.....	...	...	.....
	B195	4.5	.....	3.0	...	.....
III	355	1.3	.....	5.0	0.3	.....
	A355	1.4	0.8 Mn	5.0	0.5	0.8 Ni
	356	....	.....	7.0	0.3	.....
(c)	A132	0.8	0.8 Fe	12.0	1.0	2.5 Ni
Heat-Treated Wrought Alloys (a)						
I	11S	5.5	.....	...	...	0.5 Fe—0.5 Bi
II	61S	0.25	.....	0.6	1.0	0.25 Cr
	53S	...	.....	0.7	1.3	0.25 Cr
	A51S	....	.....	1.0	0.6	0.25 Cr
	17S	4.0	0.5 Mn	...	0.5	.....
III	25S	4.5	0.8 Mn	0.8	....	.....
	70S	1.0	0.7 Mn	...	0.4	10.0 Zn
	18S	4.0	.....	...	0.5	2.0 Ni
	14S	4.4	0.8 Mn	0.8	0.4	.....
	24S	4.4	0.5 Mn	...	1.5	.....
(c)	32S	0.8	.....	12.0	1.0	0.8 Ni
Non-Heat-Treated Wrought Alloys						
II	56S	....	0.1 Mn	...	5.2	0.1 Cr
III	46	....	1.2 Mn	...	1.0	.....
	52S	....	.....	...	2.5	0.25 Cr
	3S	....	1.2 Mn	...	...	.....

*Indicates relative machinability. Type I alloys have best machining characteristics.

(a) Heat treated as usually sold, namely a solution treatment followed by aging at room or elevated temperature.

(b) Alloy 220 is not aged.

(c) Alloy cuts freely, but wear on tools may be excessive unless they are tipped with cemented carbide.

TABLE 2—CUTS, SPEEDS, AND FEEDS WHEN MACHINING ALUMINUM ALLOYS

(See Note)	ROUGH MACHINING Max. Cut Inches	Speed (fpm)	Feed, Inches	FINISH MACHINING Cut, Inches	Speed (fpm)	Feed, Inches
LATHE TURNING						
Type I castings, not heat treated	0.25(a)	500 to 900	0.020 to 0.030	0.002 to 0.010	Maximum	0.002 to 0.010
All others	0.19(a)	600 to 800	0.007 to 0.020	0.002 to 0.010	650 to 900	0.002 to 0.010
MILLING						
Type I castings, not heat treated	0.25	400 to 600(b) / 500 to 700(c) / Maximum (d)	5 to 15(e)	0.010 to 0.020	500 to 700(b) / 500 to 700(c) / Maximum (d)	10 to 25(e)
Type I castings, heat-treated / Type II castings / Types I and II wrought alloys, heat-treated	0.25	400 to 600(b) / 500 to 700(c) / Maximum (d)	4 to 10(e)	0.010 to 0.020	500 to 700(b) / 500 to 700(c) / Maximum (d)	5 to 15(e)
Type III alloys	0.25	300 to 500(b)	3 to 8(e)	0.010 to 0.020	500 to 700(b)	4 to 10(e)
BORING						
Light duty (1 to 2 inch)	0.09(a)	Maximum(f)	0.010 to 0.020	0.010 to 0.020(a)	Maximum(f)	0.001 to 0.005
Medium to heavy duty	0.25(a)	600 to 1000	0.007 to 0.015	0.010 to 0.020(a)	600 to 1000	0.001 to 0.003
SHAPING						
Heavy duty (36 inch)	0.25	Maximum(g)	0.010 to 0.030	0.005 to 0.010	Maximum(g)	0.100 to 0.150
PLANING	0.38	Maximum(h)	0.025 to 0.100	0.005 to 0.015	Maximum(h)	0.050 to 0.375

NOTE: See Table 1 for explanation of Type numbers listed above in first column.

(a) Cut measured on radius.
(b) For carbon steel tools.
(c) For high-speed tools.
(d) For cemented carbide tools.
(e) Travel of work.
(f) Peripheral speed of tool is max. of most machines.
(g) Travel of ram.
(h) Speed of table.

TABLE 3—MECHANICAL FINISHING OF ALUMINUM ALLOYS

	ROUGHING Solid Wheel	Cloth Belt	Sewed Muslin	Greasing or Oiling	Buffing	Coloring	Finish* Grinding
Abrasive	Al_2O_3 or SiC	Al_2O_3	Al_2O_3	Turkish Emery	Tripoli	Fine Lime or Soft Silica	SiC
Carrier	Solid Wheel	Cloth Belt	Sewed Muslin Buffs	Sewed Muslin Buffs	Pocketed Muslin Buffs	Open Muslin or Flannel	Solid Wheel
Grit	16 to 100	46 to 300	46 to 80	120 to 240			30 to 40
Bond	Phenolic Resin	Glue	Glue	Glue			Vitrified
Hardness	Medium		Medium	Medium	Soft	Very Soft	Soft
Peripheral Speed of Wheel, feet per minute	6,000 to 12,000	3000	6000	6000	7000 to 8000	3000 to 4000	6000 to 7000
Lubricant	Dry or Grease	Grease or Kerosene	Grease	Grease	Grease		Soluble Oil 1 to 35 or 40

*Mechanical finish applied to castings—to be preceded by machining.

TABLE 4—APPROXIMATE FEEDS FOR STANDARD TOOLS FOR MACHINING 11S-T3 ALLOY

Tool	Cut Width or Depth Inches	Diameter of Hole Inches	Feed per Revolution Inches
BOX TOOLS One chip finishing	1/8		0.012
	5/16		0.010
	1/2		0.008
	5/8		0.008
	3/4		0.006
CENTER DRILLS		Under 1/8	0.004
		1/8 and over	0.008
CUT-OFF TOOLS Circular	1/64—1/8		0.0035
Straight	1/64—1/8		0.003
DRILLS		1/16	0.004
		1/8	0.007
		3/16	0.010
		1/4	0.012
		5/16	0.014
		3/8	0.015
		7/16	0.016
		1/2	0.017
		3/4	0.017
FORM TOOLS	1/16—1/4		0.002
	1/4—1/2		0.0013—0.0015
	1/2—3/4		0.001
	1		0.001
REAMERS	0.003—0.004	Under 1/8	0.007—0.010
	0.004—0.008	1/8 and over	0.010

With renewed interest in sub-contracting, many plants with limited experience in machining aluminum may expect to require more information on this all important war production subject.

Table 1 presents analyses of commercial aluminum alloys furnished by Aluminum Company of America. Affording a scale of relative machinability of various alloys, it may help tool engineers in designing tools and allocating equipment for new jobs. Given a new alloy for machining, they can, by using this table, determine its relative machinability as compared with a job they may be performing on another alloy. If analyses are not identical to those in the table, a comparison to the nearest equivalent may prove helpful. Tables 2, 3 and 4 are self-explanatory, with machinability types in Table 2 keyed to Table 1.

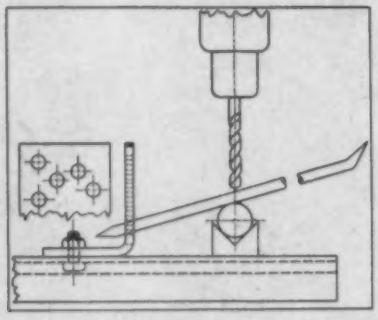
NOTE: On this page is the eighteenth of a series of Data Sheets to be published in THE TOOL ENGINEER. A handy three ring binder can be secured at any dime store to hold the sheets for quick reference.

The CRIB*

IDEAS • KINKS • SHORT CUTS

*T.M. REG. U.S. PAT. OFF.

Hold Down for Small Drill Press



AN EASY WAY to hold work on a small drill press employs an angle plate bolted to the drill press table with a number of holes through the upright face in which a bar may be inserted and used as a lever to secure the work on the table. The operator handles the bar with one hand, manipulates the machine with the other.

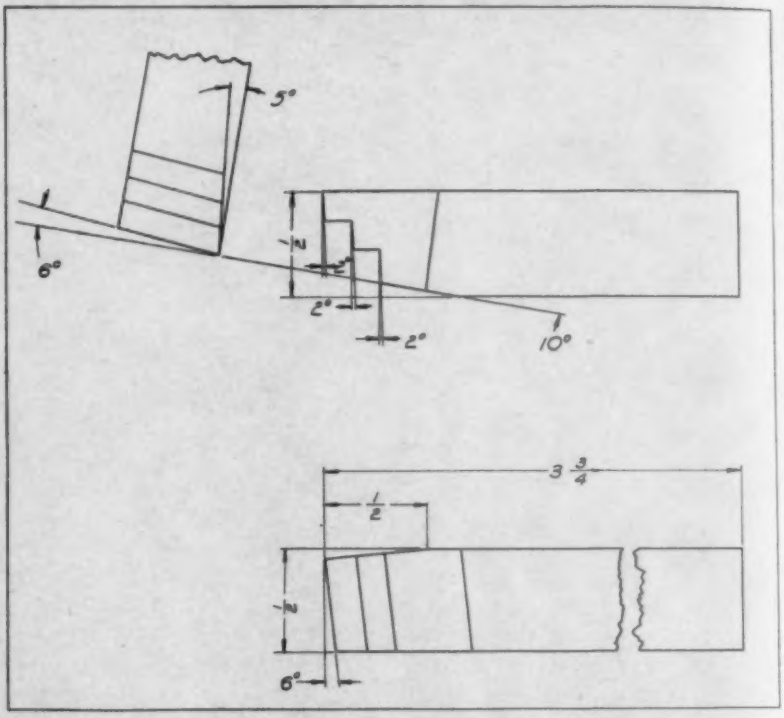
The type of bar known to most machinists as a buggy bar (shown in cut) is convenient for this purpose. The angle plate may be simply a piece of ½ by three iron, bent 90°, with a row of holes drilled in it and provision for fastening it to the table.

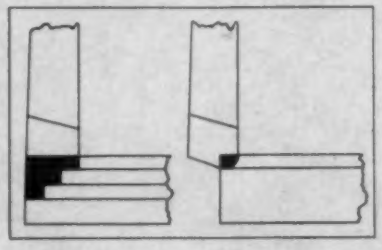
In drilling oil holes in bushings, the bar may be passed through the bushing. This kind of hold down is good for drilling shallow holes up to about ¾-inch diameter. Every small drill press in the shop should be equipped with it because mechanics, in a hurry, will attempt to hold in their hand work that should be clamped.

Another Holding Suggestion for the Small Drill Press

MOUNT a bench vise on the table to grip small parts. One would suppose these simple suggestions to be in universal use, but a trip around the country shows that this is not the case.

Heavy Duty Shaper Tool Designed to Save Several Cuts

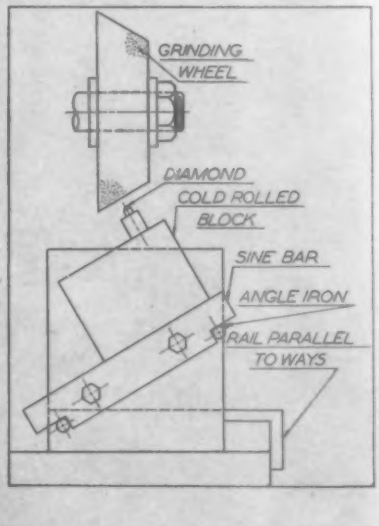




THE adjacent drawings illustrate a tool designed for heavy duty use on the shaper, where it is necessary to make a heavy cut. Rather than make three cuts, as is usual, this tool does the job shown in the larger illustration in a simple operation.

To Dress Precision Angles on Surface Grinder Wheel

THE SET-UP shown in the drawing at right can be used for dressing precision angles on the wheel of a surface grinder. The diamond must be under the center. The block can be machine steel or cast iron. The block slides on the angle iron and is guided by the sine bar which has been set to the proper angle. The angle iron must be square to the rail, which is ground parallel to the ways. The block is moved on the bar by hand.



Ideas for VICTORY

. . . from the Production Lines behind the Firing Lines

Mr. Schoen receives his Warner & Swasey Victory Pin and the congratulations of the joint Management-Labor Committee which steers the Packard Motor Car Company's WORK TO WIN War Production Drive.

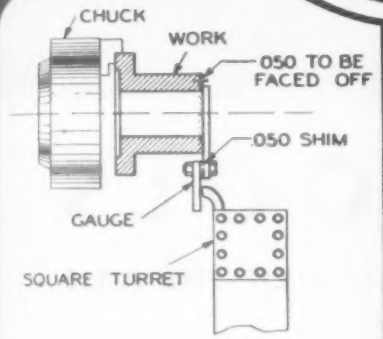
A Citation for Men in War Industry

THIS JOB SETTER WORKED OUT A TIME-SAVING WAY TO MACHINE A SHOULDER FROM A FINISHED FACE

CHARLES F. SCHOEN, a job setter in the Packard Aircraft Engine Division, which produces Rolls-Royce engines, is one of several score of turret lathe operators now wearing an Ideas for Victory Pin. These Victory Pins are given to resourceful operators who have developed practical ideas for increasing production.

Mr. Schoen's idea is explained in the accompanying sketch. To machine .050″ off a finished and carburized face when length of piece may vary from job to job, Mr. Schoen made up a gauge that provides a quick way of positioning a cross-slide tool without necessity of measuring each cut.

Many of the ideas sent in to Warner & Swasey are published in Blue Chips, a shop bulletin sent free to the homes of over 38,000 turret lathe operators. Make sure your turret lathe operators are on our list to receive it—it may bring them helpful ideas and inspiration that will be reflected in increased production in your plant. Write Warner & Swasey, Cleveland, Ohio.



GEAR BLANK—
Finish after Carburize

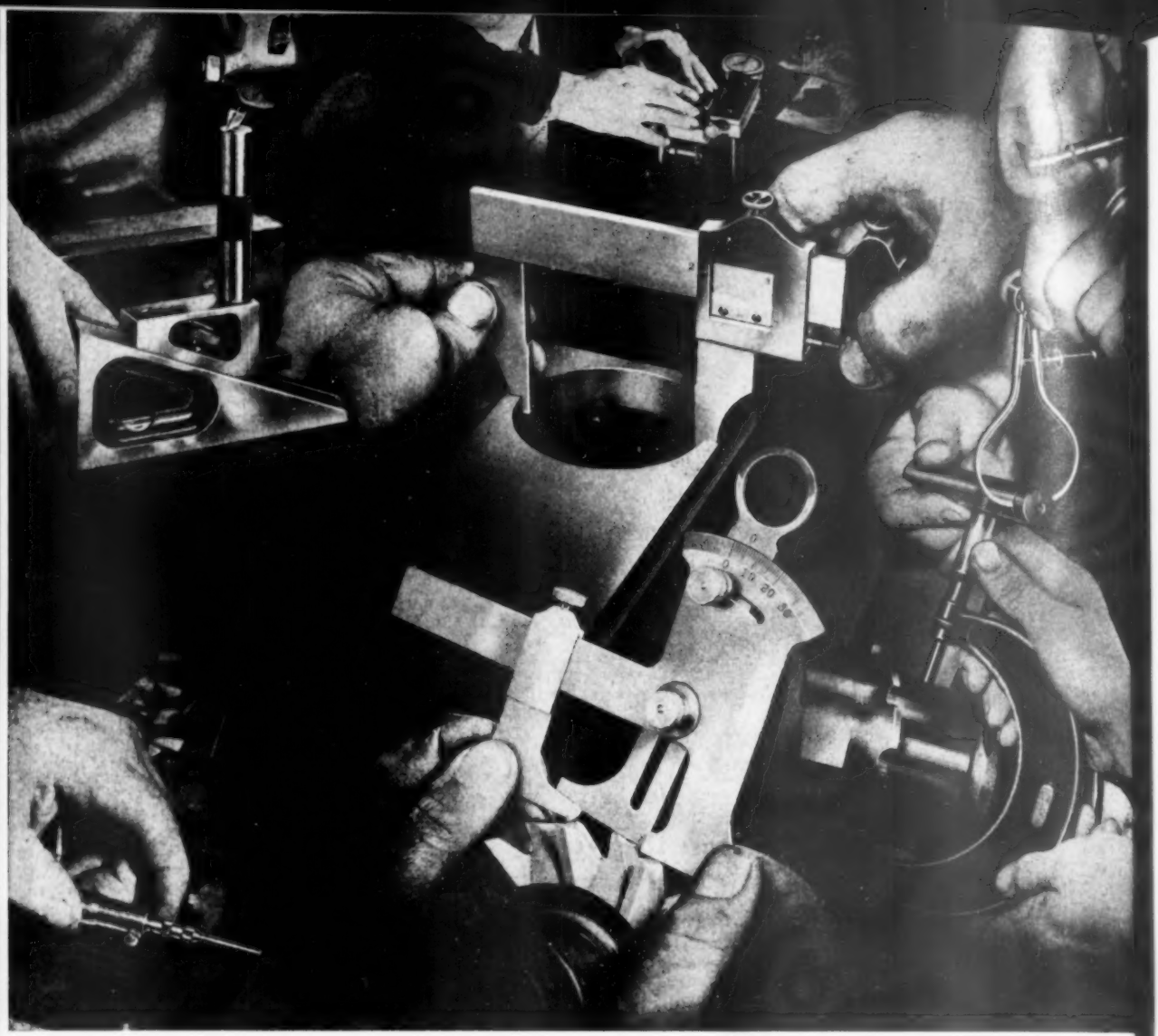
• A gauge is made by clamping two pieces of cold-rolled steel together with a shim between them, *same thickness as amount of metal to be removed.*

The gauge is placed against face of work. The cutting tool is then brought against the gauge blade and the carriage locked in this position.

You Can Turn It Better, Faster, for Less . . . with a Warner & Swasey

WARNER & SWASEY FOR VICTORY

STARRETT TOOLS



STARRETT TOOLS

HELP SKILLED HANDS TAKE THE MEASURE OF THE AXIS

Getting tools of Starrett accuracy and dependability into these hands has been a task worthy of the supreme efforts of every Starrett toolmaker. On that task we shall continue to concentrate our skill and experience without stint . . . Your mill supply distributor is likewise doing everything he can to help you procure the Starrett precision tools you need. You may depend upon him.

THE L. S. STARRETT CO • ATHOL • MASSACHUSETTS • U.S.A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Eight Ways to Improve Output per Tool

E. E. POTTER

GENERAL ELECTRIC COMPANY
NELA PARK, OHIO

TO the production engineer, getting the most out of what he has is today's axiom. It means finding ways to get more and better output per tool from all available tools . . . increasing the efficiency, and thereby the contribution to Victory, of every tool now in use on the production lines of Liberty.

Net output of any tool increases when better light is provided for the man using it. Elementary as this seems, it bears repeating since the adoption of the three-shift schedule As a result, two-thirds of American production depends upon the ability of our workmen to see clearly and quickly under artificial illumination.

Workmen using essential and often irreplaceable tools have lighting that assures maximum efficiency.

Recently, a country-wide survey was made to determine how war plants are discovering and correcting common lighting faults affecting tool-use efficiency and skill.

This study confirmed the belief of many tool and production engineers that the illumination provided the worker directly affects his skill and efficiency with tools, his safety, morale, and ability to maintain sustained output. Especially has it confirmed the fact that better use of precision tools is facilitated among employees whose vision is declining.

Net output per tool was increased in practically all the plants covered in the study, following lighting improvements that cured such major production drags as glare, interfering shadows, accident hazards, and high percentage of errors, waste and rejects in metal cutting operations.

The accuracy of hand drilling can be doubled by providing proper illumination.

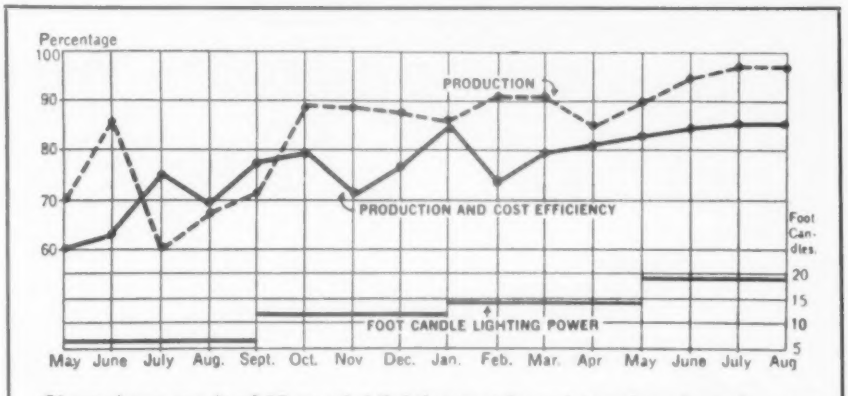
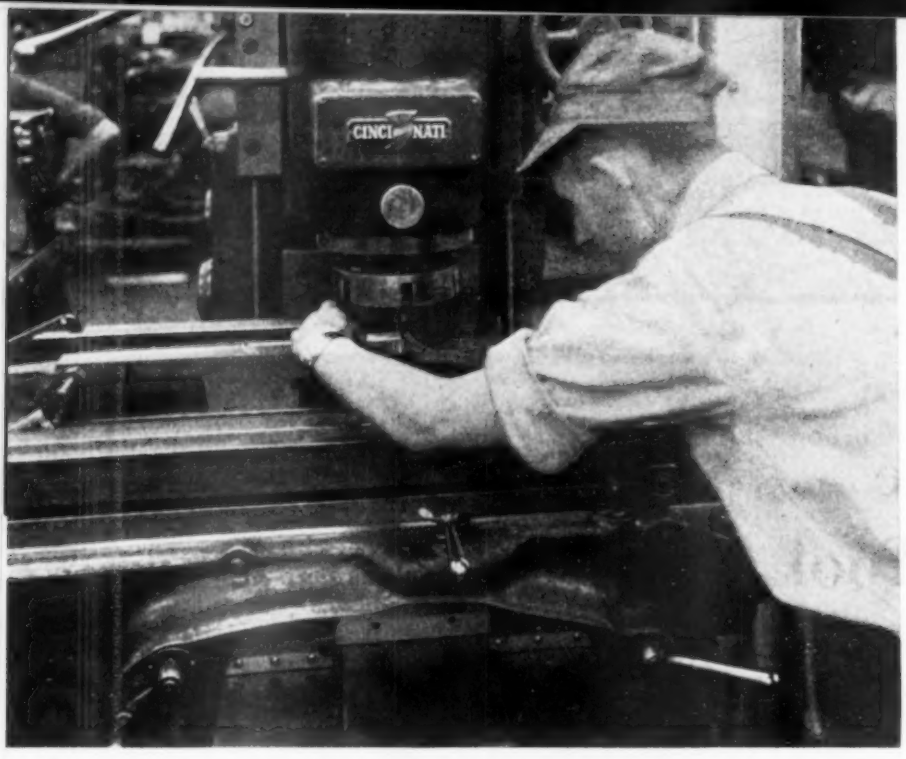


Chart shows result of 15 months' lighting test in a piston ring plant. Increasing the lighting from 1.2 footcandles to 20 footcandles stepped up production 25 percent at an additional cost of only 2 percent of payroll.

FASTER SETTING AND ADJUSTMENT

When, for example, an Indiana machine shop recalled a number of its old tool makers, foremen noticed that gage-setting and adjustment were wasting entirely too much time.

A lighting study revealed that not only the old-timers but many of the newly trained workmen were carrying micrometers to the windows for better, surer seeing. The machine shop



An Indiana machine shop reports that installation of proper lighting over machines has cut the time required for adjusting and measuring 15 percent.

superintendent reports that since the change-over to improved lighting (40 footcandles of general fluorescent illumination over the machines) micrometers are easily read, fine details are easily visible, and it now takes 15 percent less time to make settings and adjustments than it did before.

ELIMINATION OF SHADOWS

In a Michigan machine shop where the problem of accommodation was so pronounced that it seriously affected job tenure, the personnel manager recommended a complete study of the lighting.

A mercury vapor low-bay system was installed, with fixtures at a level substantially lower than the prevailing level of belts and pulleys, and much below the former high-bay system. Interfering shadows were eliminated as a problem by staggering pairs of reflectors on the columns on one side, and between the columns on the other.

The personnel manager states that his men are now doing fine work in much less time and can work longer hours with less fatigue.

This thread miller's job would be more difficult if he were not favored by ample illumination from numerous fluorescent fixtures overhead.

REDUCING EXCESSIVE SPOILAGE

A basement tool and machine shop was faced with an excessive spoilage problem aggravated by the fact that flaws did not show up until the metal had been machined down to the point where failure to spot them meant a lot of wasted work and materials.

Fluorescent reflectors were mounted between the floor joists to lift illumination from five to 25 footcandles. With better light, inspection rejects were cut 18 percent and the overall production of the shop increased by 15 percent.

ELIMINATING FACTORY BLIND SPOTS

The vice president in charge of production of a midwest plant making bronze bushings for the Ordnance Department found that an excessive percentage of employee time losses were directly attributable to minor accidents caused by workers groping for misplaced tools, stumbling over parts stored in working alleys and corners.

A 50 percent cut in accidents of this type followed elimination of the blind spots with 50 footcandles of fluorescent lighting. The vice president reports that the employees can also do their work faster. Besides these safety and production improvements, spoilage was cut 25 percent.

INCREASE NIGHT-SHIFT PRODUCTION

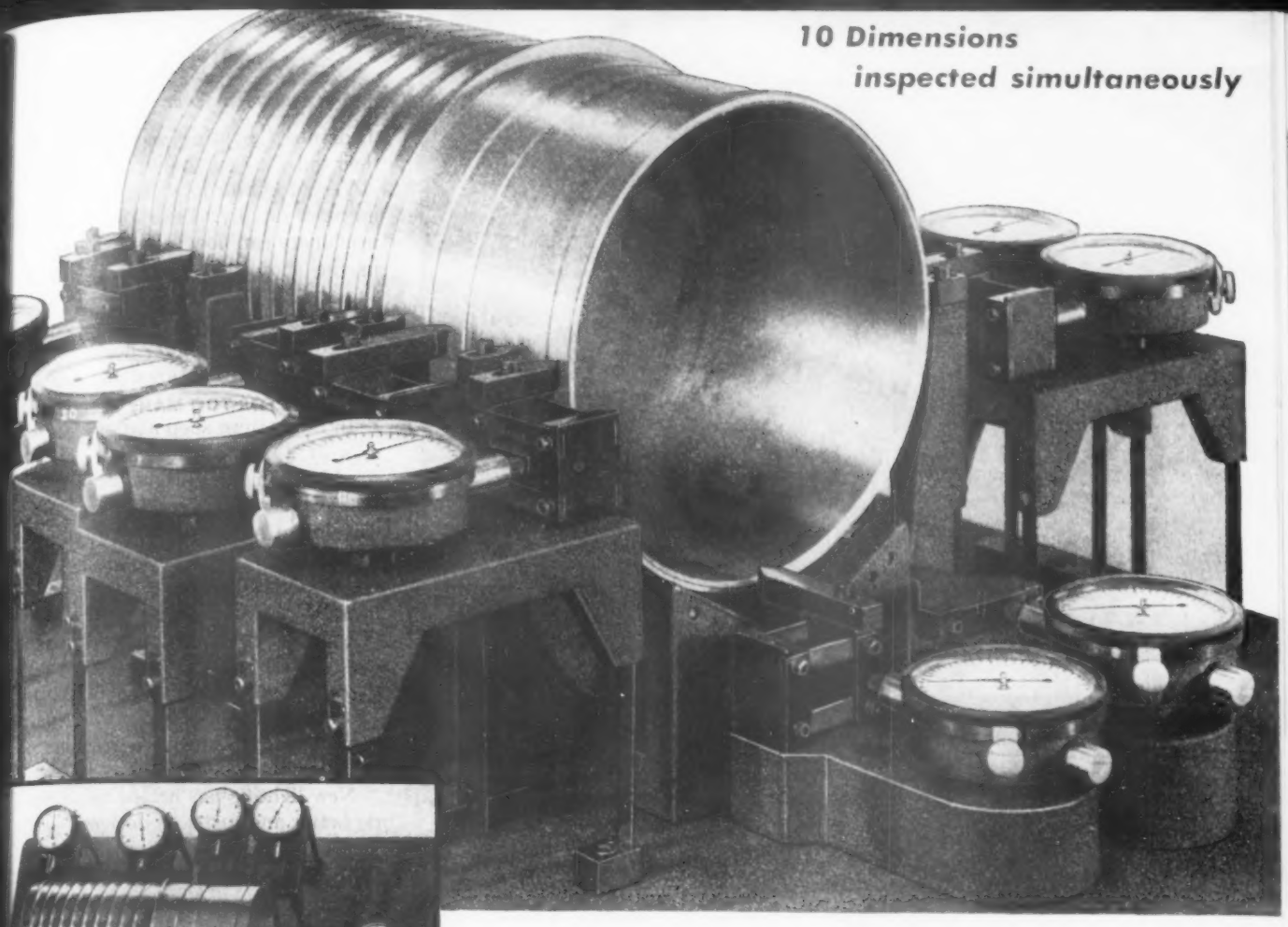
A Detroit tool and die company found that after the improvement of existing lighting facilities the machine shop night crew, using the same tools, was able to turn out more work of better quality with much less eyestrain.

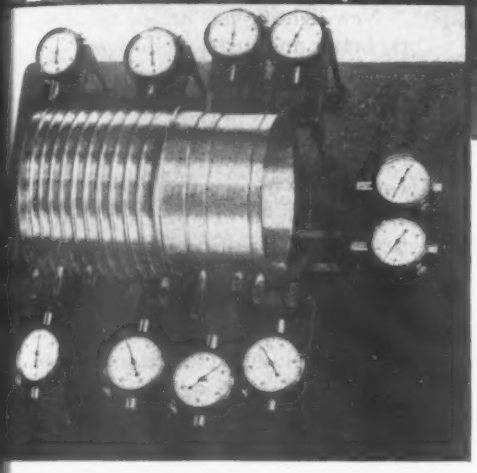
More skilled employees are willing to work nights and the plant has been able to double its output.

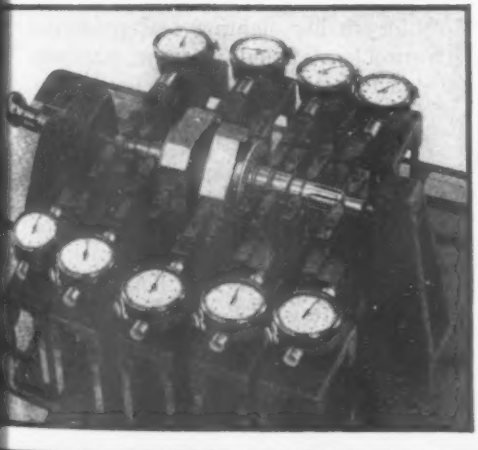
MAINTAIN OUTPUT ON FINE WORK

Men in the machine shop of a Saginaw, Michigan, tool manufacturer have found it possible to do extremely fine work for longer periods since

(Continued on page 104)







Why don't you use MACHINE GUN methods for inspection . . . . . ?

One-at-a-time inspection of dimensions is only single-shot rifle shooting. The men at the fighting front use faster methods, but how about you on the home front?

Last year the ten dimensions on the above cylinder were inspected one at a time. Now, they are checked all at once because of Dial Indicator Gage methods.

At the left, diameters of a shaft are checked in a fraction of the former time and more positively and more accurately. Investigate this fast, accurate and low-cost method of inspection. Write for more information.

FEDERAL PRODUCTS CORPORATION
PROVIDENCE RHODE ISLAND

★ ★ ★ ★ **FEDERAL** ★ ★ ★ ★ ★

PRECISION MEASURING INSTRUMENTS

Chicago · Cleveland · Detroit · Hartford · Los Angeles · Milwaukee · Montreal · Indianapolis
New York · Philadelphia · Pittsburgh · Rochester · San Francisco · St. Louis · Toledo · Toronto · Windsor

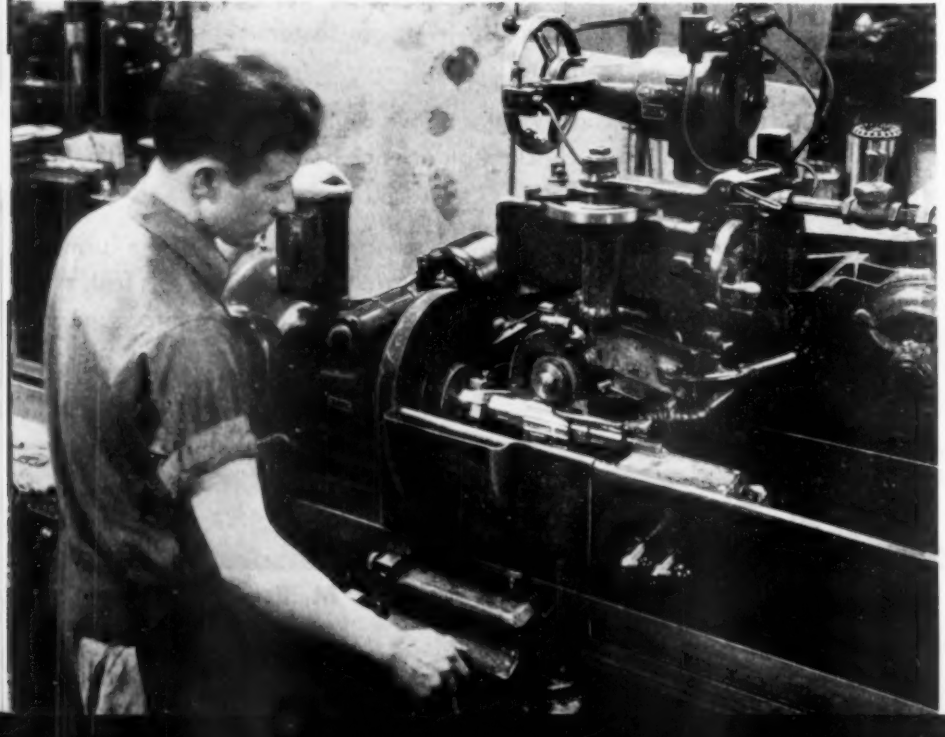
Minor accidents were cut 50 percent, and spoilage was cut 25 percent in one shop by installing 50 foot candles of fluorescent lighting.

●

Only way to determine whether machine operator has satisfactory light is to meter it, compare the reading with a chart of shop requirements.

●

"The better the light, the better the grinding job." New lights cut inspection rejects 18 percent in one plant.



(Concluded from page 102)

modernized lighting was brought to their aid.

Very accurate jobs can now be set up more rapidly. Precision tools and machinery can now be used anywhere in the shop, and there has been a substantial reduction of time consumed in setting up jobs previously caused by uncertainty due to poor and antiquated lighting equipment.

A CURE FOR TOO MANY REJECTS

In the pattern shop and production area of a Flint, Michigan, tool and machine company production has increased and employees do better work since plant re-lighting was completed. Production of small parts has increased 15 percent and inspection rejects have been cut the same.

EASING EYESTRAIN ON FINE WORK

In the screw machine department of a Vernon, California, tool manufacturer employees used to walk away from their machines every hour or so to relax.

New lighting has helped these men do better and faster work over longer periods of time, and inspectors on the night shift now turn out as much work as those on the day shift. Moreover, there are fewer rejects and fewer complaints of eyestrain.

Putting light to work is not necessarily a matter of replacing a system now in use. With the help of trained local lighting engineers, there are many ways to make better use of present lighting fixtures and lamps.

Very likely the application of better lighting to get more efficient use and higher output from existing tools in these eight plants will suggest cures for similar lighting and production problems found in other war work factories.

With the necessity more urgent than ever for getting better production from older tools as well as older men, the need for a re-check and possible re-arrangement of present lighting facilities is apparent.

Mere abundance of light does not constitute good lighting. Fine assembly or inspection may require an intensity of from 20 to 100 foot-candles or more. For less severe tasks, intensity between 10 and 20 foot-candles may be enough. Industrial lighting equipment manufacturers and utilities will provide tables showing recommended intensities for all types of work.

THE END

Reclaim Your High Speed Steel Cutters

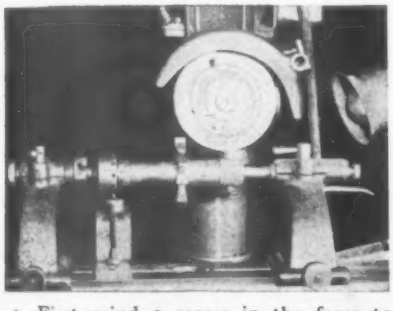
By Brazing-on STANDARD CARBIDE BLANKS

When your high speed steel cutters are "worn out", don't scrap them. They usually can be reclaimed by simply torch-brazing standard carbide tips to the cutting edges of your cutters.

Standard styles of carbide tips are readily available to meet practically all carbide tipping requirements for all commonly used types of high speed steel cutters. With a small master stock of standard tips in your crib, you'll be prepared to reclaim and re-tool fast.

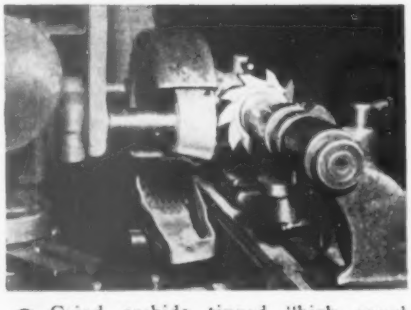
Complete instructions on request.

THREE EASY STEPS AND YOUR OLD CUTTERS ARE RENEWED



1 First grind a recess in the faces to which the carbide tips are to be brazed. Plan recess so that tips will project slightly over edge—for grinding back to size. Bottom of recess should be ground flat surface but not necessarily smooth.

2 Using an oxy-acetylene torch, flux, and silver solder, braze standard carbide tips in place. Process is essentially the same as regular braze for carbide tools—except braze should be completed fast to prevent oxidization and loss of chrome.



3 Grind carbide tipped "high speed steel" cutter in same way you regularly grind any carbide tipped cutter. Cutter is now ready for many times life of the original. When again worn, you can often resize using same process.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

11145 E. 8 MILE ST., DETROIT, MICHIGAN

Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

√ Brazing literature sent on request.

CARBOLOY TRADEMARK CEMENTED CARBIDES

TOOLS • DIES • DRESSERS • MASONRY DRILLS • WEAR RESISTANT PARTS

A DALZEN *WILL DO IT!*

Dalzen tools — taps, flat and round broaches, thread milling hobs — have the same high reputation for accuracy and dependability as Dalzen Thread Grinders and Center Lapping Machines. Sturdy, compact, efficient, Dalzen machine tools give maximum production per cubic foot, per pound, per dollar of cost! Write for descriptive literature.

WHITWORTH AND NATIONAL FORM GROUND HIGH SPEED TAPS

• You can rely on Dalzen as a dependable source of tap supply. Here's why:

DALZEN CAN DELIVER the size you need with the speed your production schedules require.

DALZEN SPECIALIZES in hard-to-get Whitworth form taps from size 12-BA up to 6" in diameter.

DALZEN TAPS ARE PRECISION GROUND of hardened high speed steel — assure clean, accurate cuts with maximum tool life.

When ordering, give size, form, and quantity data. Prices, descriptions, and earliest delivery date will be rushed.

DALZEN IN AIRCRAFT

Ground thread parts are being produced on contract for leading aircraft engine manufacturers. For detailed data on this service, submit blueprints and specifications when making inquiry.

DALZEN

TOOL & MANUFACTURING CO.

12255 EAST 8 MILE ROAD • DETROIT

GENERAL CAMPBELL –

$52,000,000,000 Administrator

U. S. Army Photo

Maj. Gen. Levin H. Campbell Jr., Chief of Army Ordnance, who enjoys recognition both by the Army and American industry as an outstanding engineer and administrator.

WALLACE A. SCOTTEN
ASSOCIATE EDITOR

RIGHT or wrong, a sizeable segment of American management in the mass production metal cutting field has long been inclined to cast the khaki-clad representatives of the Army's Ordnance Department in the role of fledglings bent on telling old masters how it should be done.

This global war has changed many conceptions, and not the least of them is that one. Notable reason is a stocky, 57-year old live-wire who heads a 52-billion dollar metal cutting business and holds the rank of Major General — with no pose of austerity. His name? Levin H. Campbell, Jr., Chief of Ordnance of the United States Army.

Long accustomed to developing their own manufacturing methods and formulating their own industrial policies, many a manufacturer converted to war production was pleasantly surprised when he went to work for the Ordnance Department. Here was an outfit that knew what it wanted, knew what tools were needed to build it.

Knowledge of engineering

The result has been a remarkably firm bond of common understanding, previously unheard-of exchange of technical know-how and mutual respect between Ordnance and civilian engineers.

Anyone who has done business with burly, blue-eyed General Campbell can give you the answer to this enigma. It's this one man — his manners, his methods and his knowledge of engineering and industry.

The smooth functioning organization that is Army Ordnance today is built on certain principles that are Campbell's alone. Outstanding among these is his belief in giving subordinates both autonomy and responsibility. The department's approach to the problem of supplying the nation's fighting men with billions of dollars worth of weapons is completely explained in his remark, "If a man had to eat an elephant, first he'd cut it up into small pieces."

"Imbued with the energy of three or four men," one of his lieutenants says, "he began decentralizing his department five minutes after he took over as Chief of Ordnance on June 1, 1942."

Inclined to be epigrammatic, the General remarked that day, "I don't want anybody breathing down anybody else's neck." The same day he started getting the operating division of his department "the hell out in the field where they belong" and where they can cooperate more effectively with private industry.

Advantages of decentralization

Industry's reaction was natural. Its men could thresh out their problems with Army men over a bowl of soup and cup of coffee at their plant instead of throwing their shop plans and tooling problems into a brief case and wedging their way into a jam-packed Pullman for Washington while work at home piled higher and higher.

Very tangible results in increased efficiency resulted from this saving in travel time to and from the Capital. The over-all savings may be judged by the fact that Ordnance continually is in the process of buying 1,200 to 2,000 completed metal products ranging from .30-caliber bullets to 40-ton tanks composed of thousands of dissimilar parts.

The speed with which these operating divisions got the production job under way is a tribute to Campbell's orders permitting them to do the buying without dallying around with Washington, and sign contracts up to $5,000,000 without consulting the office on the Potomac.

General Campbell is no stuff-shirt administrator. He is a coldly practical man. Since the Army knew what it wanted and industry had to carry the burden of producing it, he decided that industry should have a word to say about the designs and methods to be used in producing ordnance equipment. Each, he reasoned, could learn a lot from the other. And each has. In January, 1942, when the General became Assistant Chief of the Industrial Service in the Ordnance Department, in charge of all production, he organized the present system of industry integrating committees (See THE TOOL ENGINEER, January 1943, page 114).

"Guns are machines"

These committees are composed of engineers and production men representing plants making ordnance articles. They meet regularly with Army engineers to discuss production problems and exchange ideas. The best ideas advanced at these meetings are adopted and made uniform practice in industry.

The mechanical time fuse committee, for example, discovered so many new techniques that three of the plants previously engaged in its manufacture were diverted to the Air Corps for another type of work. Last reports indicate the mass production of this fuse still has the Germans baffled.

This instance bears out the General's recent admonition to those who fear the mechanical ingenuity of our enemies. "Guns are machines," he said. "Nobody in the world makes better machines than are made in the United States. You wouldn't believe Germany or Japan could make better automobiles. Don't believe they can make better guns. They cannot."

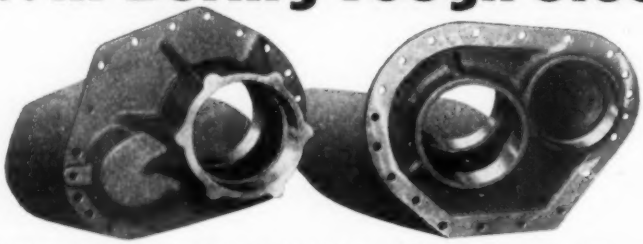
Bottleneck solutions roll from Campbell's desk at a dime a dozen. Take, for example, the device he whipped up to break a two-year problem of ordnance machine tools. In each Ordnance District he has organized unpaid, advisory Machine Tool Panels. These panels are composed of 20 to 30 ma-

(Continued on page 109)

"If a man had to eat an elephant, first he'd cut it up into small pieces." That's the way the Ordnance Chief is handling one of America's biggest production jobs.

23½ Minutes Saved...

...in Boring Tough Steel



UNIT-TYPE MACHINE *(designed for job)* BORES 3 HOLES SIMULTANEOUSLY

Rough and finish boring operations are both performed on this 3-spindle unit-type boring machine. Feed is .010" for both roughing and finishing — depth of bores is held to .003". Former time on a special machine was 62½ minutes including roughing and finishing. Present time is 39 minutes including both operations and, *a milling operation previously done on another machine.*

Actual cycle time of the machine is approximately 3 minutes and consists of rapid approach, feed, dwell, and rapid return. Both heads bore simultaneously.

This is but one example of how unit-type special machines increase production. Perhaps you can save time or manpower in a similar way . . . our engineers will be glad to help.

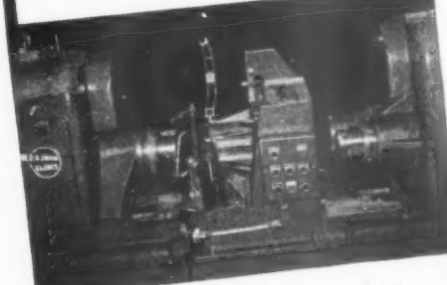
MORE PRODUCTION AND TOOLING IDEAS

Free! Not a catalog, but a set of eight bulletins describing a better way to get better machines. Each bulletin traces a machining problem from the original study of the part to the final machine design. Each may suggest a more productive tooling set-up that you can use today — valuable file information for tomorrow. Write for bulletins: M-30 through M-38.

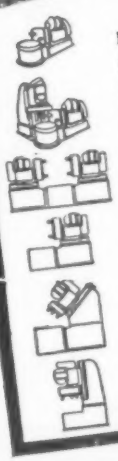
W.F.&JOHN BARNES

TOOLING ONLY IS SPECIAL

Only the spindle heads and fixture on this installation are special. The remainder of the machine is of our standard unit construction as illustrated below.



You Can Save From 20 to 35% with Unit-Type Machine Tools



Initial cost of these special machines is lower because drawings and patterns are available. You save engineering and pattern costs on complete feed and drive units.

Boring, drilling, reaming, tapping, and milling operations can be done simultaneously. Best combination to suit your production is available. And, future changes in your part design won't cripple the machine—units can readily be re-arranged to accommodate changes.

W. F. and JOHN BARNES

325 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

(Continued from page 107)

chine tool dealers.

Chief object of the machine tool manufacturer is moving new machines out to his dealers. The dealers, on the other hand, are occupied with supplying buyers with any type of machine tool they require, regardless of its make. Consequently the dealers know who has what kind of machines in their territories. Some 4,500 machine tools have been located by these committees and brought into use in plants sorely needing them.

No parts, no pay

While the General may have been a Fairy God-Father to many a red tape-ridden industry, he has also yanked a few of them up by the pants. Spare tank parts is a good example. Before he slid behind the big desk in the Ordnance Department, the Army was experiencing difficulty in securing sufficient spare tank parts.

His solution was severe but simple. He quietly passed the word around that unless the tank makers sent the necessary replacement parts along with the tanks, they might have a little trouble finding their money on pay day. Parts quotas immediately were met 100 per cent.

Probably outstanding among the projects fathered by this life-long Army man is one that makes civilian government's efforts at Washington decentralization look puny. This project, Detroit's Tank-Automotive Center, is a model in government-industry cooperation that stands alone on the Allied war production front.

It was only natural that Dynamic Detroit, hub of the automotive industries, with its factories, engineers, executives, and skilled labor, should be the focal point in the production of heavy mobile machinery for the United Nations. Realizing this, in one bold stroke the General lifted the automotive supervision work from congested Washington and placed it in the heart of the greatest metal cutting industry in the world.

The result was an organization in the motor city headed by men who had worked with their hands, men who had spent their time at a lathe and drill press, and charged with the job of handling approximately 99 per cent of all tank and automotive work of the Ordnance Department. Today, this organization is directing the output of more than 200 types of tanks and wheeled-guns and vehicles. Its present program calls for expenditures totaling $25,000,000,000.

Here, if anywhere, is evidence of Campbell's reliance on industry. As chief of the TAC he installed not an army man, but a former automobile manufacturer, A. R. Glancy. Brig. General Glancy was formerly president of Pontiac Motor Car Company and a vice-president of General Motors Corp.

Not a desk man

Though General Campbell is not a dramatic figure himself, he does things in a dramatic way. For his Tank-Automotive Center, he commandeered a 40-story downtown-Detroit skyscraper and installed dozens of top-ranking automotive engineers and executives in 10 acres of office space.

The Chief of Ordnance, however, definitely is not a desk man. He spends as little time in Washington as possible. He likes to fly, and spends much of his time in the field asking the men who use the tools of war how their equipment is standing up, what can be done to improve it. Inspection of our allies' ordnance manufacture is one of his musts.

The background of this man who enjoys so much respect as an engineer and administrator has been one of life-long association with the Army. The one exception was his formal schooling. He is a graduate of Annapolis.

Contributions to production

Associated with the Ordnance Department since April 1918, probably his most meritorious contribution to armament production came during his service at the Frankford Arsenal commencing in 1935. There, he revolutionized the art of artillery ammunition production in several of its most important phases, namely the machining of shells, the manufacture of cartridge cases, and the production of mechanical time fuses. It was he who brought the method of straight line, quantity production to the government arsenals and who paved the way for the great expansion in production methods which has characterized the U. S. Ordnance-industry effort in this war.

Reason for the remarkable esprit de corps in his organization may be one of his favorite sayings, "There are three things a man can do: The first and the best is the right thing; the second best is the wrong thing; and the third and only unforgiveable thing is doing nothing." THE END.

PLASTICS IN RADIAL ENGINES

Plastics are finding wider usage as prime materials in mass production. Here are two important parts for radial engines in which plastics have replaced aluminum.

THE increasingly important role plastics are playing in mass manufacture is evidence in their recent application in airplane engine production by the Wright Aeronautical Corporation.

Used in this concern's big 14 and 18-cylinder radial engines, plastics have replaced sheet-aluminum in two important parts. Results include the saving of thousands of pounds of vital metal monthly, doubling the service life of the parts involved, decreases in engine weight, and substantial savings in manufacturing time and costs.

The parts, baffles or air deflectors, and push rod housings, were developed by Wright engineers in cooperation with the Panelyte Division of the St. Regis Paper Company. Before being placed in mass production, the parts were tested on single-cylinder and full-size engine test stands, and then in actual flights of more than 300,000 miles.

Made in one operation compared with five when fabricated from metal, the plastic parts are formed under applied heat and pressure in molds. A base material, such as cotton fabric, is impregnated with phenolic thermosetting resin.

Plastic baffles are used to deflect the airstream so that it flows over and cools the entire finned surface of the cylinders. Without baffles, the air tends to cool only the front surface. On double-row engines, the baffles provide the rear bank of cylinders with the same volume of air that flows over the front row. Saving in weight of plastic over metal in the 42 baffles used on a 14-cylinder engine amount to 25 per cent.

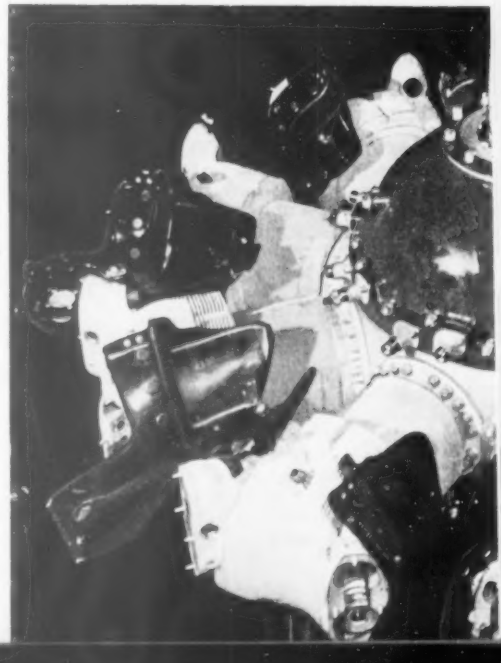
The push rod housings, tubes twelve inches long and one inch in diameter, cover and protect the push rods which extend from the cams in the crankcase to the valve assemblies in the cylinder head. These housings also serve as a return channel for oil carried to the entire valve mechanism. Inasmuch as a 14-cylinder engine carries 28 of these housings, savings in aluminum and weight are considerable.

When made from metal, push rod housings were first cut from aluminum sheet, shaped to the curve of the cylinders, and then heat treated. In an electric bath, they were anodized to create a corrosion-resistant surface and form a bond for paint. Three coats of paint completed the operation.

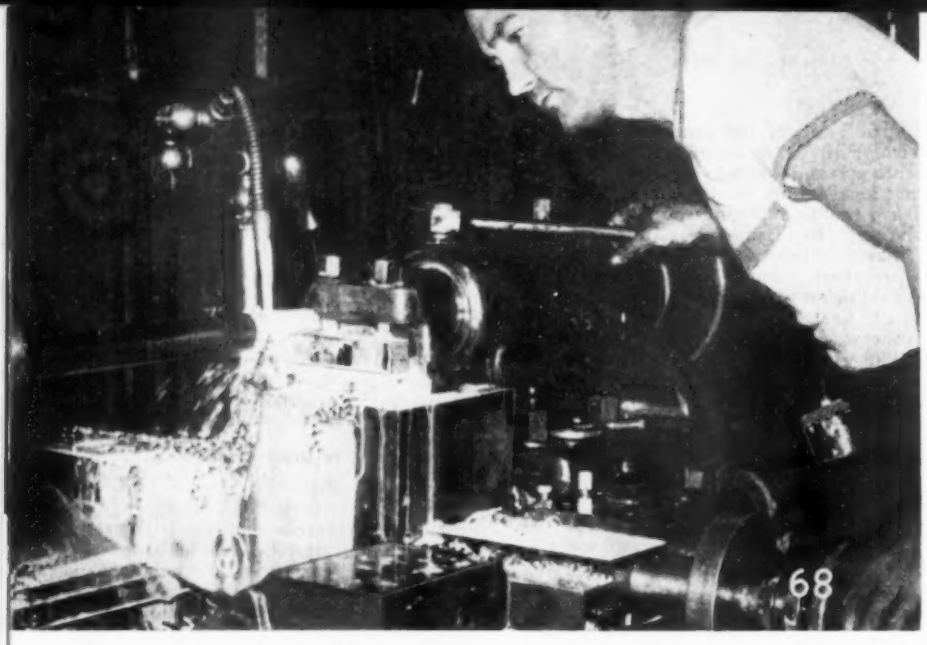
Plastic baffles, light, strong and more resistant to corrosion than aluminum, are not painted as a dye is mixed with the plastic ingredients.

Other radial engine manufacturers are expected to adopt these plastic parts as standard, thus releasing tremendous quantities of aluminum monthly in the aircraft industry. THE END.

Wright Aeronautical Photo



Mass manufacture of radial aircraft engine cylinder baffles of plastic by Wright Aeronautical Corporation has released huge quantities of aluminum.



"An ample flow of coolant is necessary to carry away the generated heat," is the title on this scene from the new slide film "Putting Carboloy Tools to Work".

PICTURES *will speed* PRODUCTION

● As a partial solution to the problem of training thousands of "green" workers in the use of tools and machines, hundreds of industrial organizations engaged in war production are today utilizing movies and slide films.

Many of these pictures, which can be shown in a semi-darkened room in the plant, are designed to train skilled workers in the use of new tools and new materials. Others are so fundamental that they are best used in speeding the training of the thousands of new employes who are going to work on the production front in metal cutting industries. (See **The Tool Engineer,** February 1942). Projection equipment can be bought or rented through local photographic supply shops.

As a service to mass production engineers faced with the problem of converting industrial initiates into semi-skilled or skilled workers, **The Tool Engineer** reviews here a few such films recently made available.

TOOL CONSERVATION

"SAVE THOSE TOOLS": Here is a one-reel, black and white sound picture which shows how the International Harvester Company's tool salvage program was organized. The film details the program for the utilization of excess and obsolete tools from salvage at individual plants to a central clearing house.

This is a film for foremen and engineers, but workmen should profit from seeing it. Emphasized is the low-temperature brazing process of repairing broken or damaged tools.

Regrinding to smaller sizes or reworking to different types is explained. Slitting saws, reamers, drills, broaches, hobs, milling cutters, etc., are repaired, ground smaller, or remade to conserve vital tool stock.

This picture has been commended by the WPB, and numerous large concerns cognizant of the acuteness of the perishable tool problem. Prints are available in both 35 and 16-millimeter sizes, with no charge other than transportation.

Write: International Harvester Company, 180 North Michigan Avenue, Chicago, Illinois.

USE AND CARE OF CARBIDE TOOLS

"PUTTING CARBOLOY TOOLS TO WORK": This is a 35-millimeter silent slide film which is designed to expedite the training of new workers in the use, care and handling of carbide tools.

This film is one of six developed and made available without cost by the Carboloy Company, Inc. It is [illegible] mercial and is designed for instructional purposes in industries using carbide tools, and deals with setting up and actual cutting operations. In 118 different panels, each of which can be held indefinitely on the screen for student study, such salient points are explained as tool posts, tool holders, machines, speeds, feeds, and depth of cut.

Available at five cents apiece is a supplementary booklet for student study in which stills from the film are reproduced. Tables of pertinent data are included for the daily use and handling of carbide tools. A booklet has been prepared on each film.

Titles of the five other films in this series are: "What is Cemented Carbide," "Designing Cemented Carbide Tools," "Brazing Cemented Carbide Tools," "Chip Breakers and their Application."

The films are available for permanent workers training programs at the approximate cost of printing, which is $20 for the complete set of six. The films also are available for loan through film libraries maintained by colleges in many states.

Write: Carboloy Company, Inc., Detroit, Michigan.

FOR HEAT TREATERS BY HEAT TREATERS

"HEAT TREATING HINTS (Second Edition)": Just released, this 16-millimeter, sound, color movie is practical, instructive and presents valuable hints on the best in modern heat treating practice.

Prepared by Lindberg Engineering, it was photographed in the world's largest commercial heat treating plant, where more than 5,000,000 pounds of metal are handled each month. It runs for 45 minutes.

Presented in the film is a simple method of scale-free hardening when an atmosphere furnace is not available; basic quenching suggestions; scale-free hardening of tools and dies in a molten boric acid bath; how to shrink a drawring back to serviceable life after it has been worn beyond useful tolerance; the old blacksmith trick of tempering springs by igniting the adhering quench oil.

This film, as well as a first edition released last year, is loaned without charge except transportation.

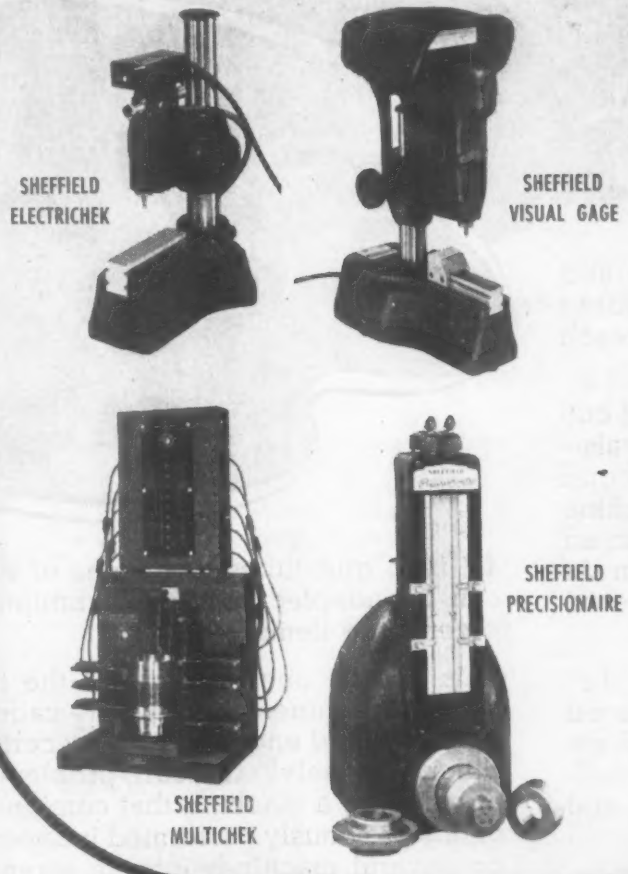
Write: Lindberg Engineering Company, 2450 W. Hubbard Street, Chicago, Illinois.

THE END

Dramatic and educational scene from the new sound, color movie, "Heat Treating Hints".

This scene shows scale-free hardening by protecting the surface with molten boric acid.

don't let faulty inspection cause you to scrap good parts . . . . .



It has been repeatedly found that close tolerance parts rejected by fixed size gage inspection were quite often within limits when checked on a Visual Gage. In other cases, parts accepted by the fixed size gage are rejected by this more precise gaging instrument. The difference is the human factor—skill—experience—temperament—health.

Sheffield Gaging Instruments remove the human factor and in addition provide greater precision and faster inspection all at lower inspection costs. Write for Bulletin No. 43-1 describing the Visual Gage, the Precisionaire, the Electrichek, and the Multichek.

THE **SHEFFIELD** CORPORATION

DAYTON, OHIO, U. S. A.

SHEFFIELD GAGES

MILLING

Another UNUSUAL JOB ENGINEERED BY LEMAIRE

Here's a machine designed and engineered to mill slots on huge gun tubes—two in the rear end and two in the breach ring threads.

Through an ingenious arrangement of cutter heads—operating at different intervals—all under automatic control—while the gun is held stationary on the bed—this machine enables the user to perform in less than an hour the work which formerly took him six hours to complete.

Though designed and engineered expressly for milling 90 MM. and 4.7 inch gun tubes, machines of this type can be adapted for use in milling many other large items.

This is only one example of the types of special machines we are daily called upon to design and engineer to meet certain conditions—or solve difficult problems—often developing a machine that combines operations previously performed independently on several machines into an arrangement on a single machine.

The motions of this machine are too complex to describe in full detail in this limited space. We shall be glad to give you this description, however, if you will write us. Perhaps you would like your production materially increased. Perhaps we can design and build a machine to meet your requirements. A consultation with us will not obligate you.

BUY WAR BONDS

LeMaire TOOL & MFG. CO.

2663 S. TELEGRAPH ROAD ▲ DEARBORN, MICHIGAN

ENGINEERS AND BUILDERS OF PRODUCTION MACHINES

at threats to stud setting speed and efficiency!

HERE'S an Apex stud setter of brand new design, with the smallest O.D. we know of. It works close to shoulders, projections, etc., drives easily and accurately in tight spots normally hard-to-reach. Proves to be a simple, effective tool for either hand or power operation. *Important:* It's an ideal tool for "green" hands. It's easy to adjust, and once set for desired length of thread on stud, *stays adjusted.*

Four sizes supplied for studs up to 1¼" in diameter. Your choice of Morse taper shanks, hex drive, T-handle combination with female square for torque wrench.

Stud setters are only one branch of the Apex family of fine production tools. Write for any of these catalogs listed below.

Chuck and tool holders: Catalog No. 14; Power bits and hand drivers for Phillips screws: Catalog No. 15; Power bits for slotted head screws: Catalog No. 16; Power bits and hand drivers for clutch head screws: Catalog No. 17; Stud setters: Catalog No. 101.

APEX

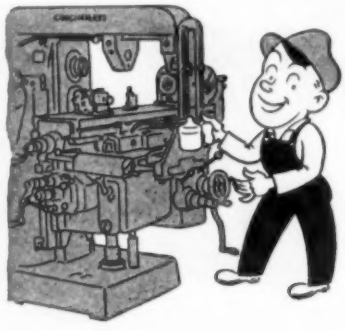
THE APEX MACHINE & TOOL CO., DAYTON, OHIO

Manufacturers of Safety Friction Tapping Chucks, Quick Change and Positive Drive Drill Chucks, Vertical Float Tapping Chucks, Parallel Floating Tool Holders, Power Bits for Phillips, Slotted Head and Clutch Head Screws, Hand Drivers for Phillips and Clutch Head Screws, Aircraft Universal Joints, Plain and Universal Joint Socket Wrenches.

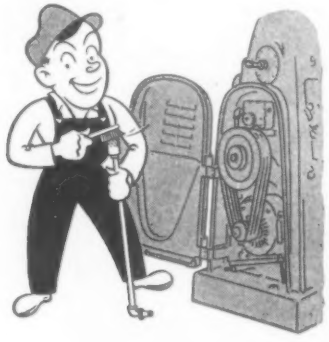
A LITTLE EFFORT NOW..

May Save Days of Production Later

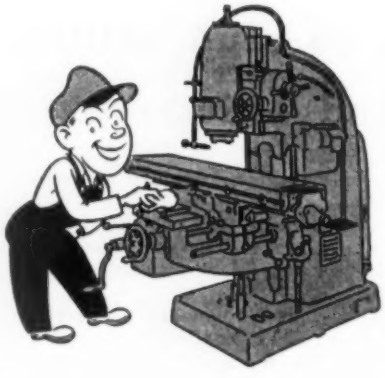
No. 1 of a series of articles pointing out the necessity of routine attention in keeping mechanical equipment in operating condition. This article covers the CINCINNATI Dial Type Milling Machines.



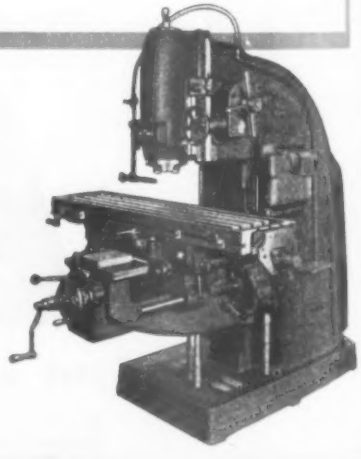
Oil your machine at the beginning of each shift. Periodically drain oil reservoirs and refill with clean oil, every two to four months—*not over six months* while running one shift. An oiler working from a lubrication department will do a better job. Follow printed instructions, (publication No. M-1084-2.)



When using coolant, clean the intake strainer occasionally. Use plenty of coolant to avoid burning cutters.



Using a soft rag, wipe exposed bearings clean twice a day. Top of knee (front and rear). Face of column and knee dovetail (above and below knee). Dovetail under table (both ends). Dovetail under overarm (horizontal machines) and vertical head ways (vertical machines). Oil these surfaces after wiping them clean.



•Like any mechanical equipment, machine tools require routine attention to keep them running. CINCINNATI Dial Type Milling Machines are designed to counteract many of the tendencies of operators and service supervisors to overlook or neglect this routine attention. Catalog M-970-1 describes all these features of long life, in addition to listing complete engineering specifications. You may obtain a copy by writing to the address given below.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO CINCINNATI OHIO U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

Industrial News Digest....

A review of significant developments and new techniques in mass production industries.

Kansas City Pratt & Whitney plant nears completion

Eight months after ground was broken, the big Pratt & Whitney engine plant at Kansas City, Mo., has commenced operations. Not far distant, the company has announced, is the day when this midwest city will be making a major contribution to the supply of aircraft engines for American fighting ships.

Size: Rivaling in size the concern's home plant at East Hartford, Conn., the new unit will eventually reach a production running into thousands of engines annually.

More than 1,000,000 square feet of floor space already is under roof, and during February and March machine tools were delivered at the rate of 125 tons a day. Already, hundreds of these machines are now in production.

The new plant, designed specifically for the production of 2,000-horsepower Double Wasp engines, has taken on the appearance of a factory working at full blast. Full production is still several months away, the company has stated. The time elapsed between breaking ground and peak operations will be approximately the same as has been required by the automobile manufacturers to get into production on aircraft engines, Pratt & Whitney believes.

Utilizing previous training experience gained in its East Hartford plants, Pratt & Whitney has worked out a training program that made it possible to have hundreds of skilled workers ready to take their places at machines when the first tools were installed in the Kansas City factory.

As soon as ground for the new plant was broken last July, picked men from that area were sent to the company's home factories for instruction as foremen and teachers.

Foreman and Instructor-trainees returned to the mid-western city last November where the new Kansas City training school was ready to prepare thousands of green workers for the highly skilled trades demanded in aircraft engine building. The school was then equipped with more than 100 machine tools and will eventually have a capacity of more than 3,500 machine tool operators a month.

Jeffers discusses rubber outlook in Tool Engineer interview

"We can win it together or lose it together." The speaker, portly, pugnacious William M. Jeffers, was discussing the Battle of Rubber. The former head of the Union Pacific, who left that booming railroad to undertake the management of the nation's rubber reserves, was conferring with a small group of top-flight automotive engineers in Detroit a few days ago.

Conspicuous at Jeffers elbow during the meeting behind closed doors was Ford's metal and chemical expert, H. R. McCarroll, Chrysler's chief engineer, Fred Zeder, and General Motor's researcher, Charles Kettering.

Fifteen months: Gist of the rubber czar's observations in an interview during the meeting was the fact that the synthetic rubber program now is on a firm foundation, that the processes to be used have been decided upon, that the plants have been located and construction commenced. Already two of these plants are producing, he said, "and the remainder should all be within 15 months."

In answer to this reporters query on the percentage of crude stocks and synthetic output going to industrial purposes, Jeffers stated that all the crude except a small quantity for truck tires and all the synthetic except that used by tire firms for experimentation is going to "military and industrial purposes." Though he refused to be quoted on an exact figure, he agreed that so-called industrial purposes probably were getting more than 90 percent of the supplies.

Optimistic, though conservative, the rubber co-ordinator said frankly that the program was behind the vision of the Baruch report. The danger point in crude supplies will be reached in November or December of this year, he observed, but the 25 to 27,000 tons of reclaimed rubber being processed monthly is ample to keep all civilian cars on the nation's highways for the next two years. The 35-mile an hour speed limit, if rigidly observed, will be our salvation on the home front, he believes.

"Estimating our synthetic production next year is foolish," he said. "No one, even the experts, can foretell the actual production of a unit. You must wait and see what it will actually produce."

Jeffers shattered all hope, embodied in a report current the past month, that rubber from Malaya was reaching the U. S. via Russia. "If it is," he replied firmly to our inquiry, "we haven't seen any of it."

(Continued on following page)

More on Glass Gages

O.W.I. Photo by Palmer

A glass gage compared with a steel plug gage it replaces at the Frankford Arsenal. A plain ring glass gage is in the foreground. (See THE TOOL ENGINEER—Nov. '42; Jan. '43). More extensive use of glass is not expected to hit regular gage makers adversely as they use the same process in finishing both types. Some Ordnance officers are reported dissatisfied with "premature" publicity given the glass substitute, and at least one gage maker is known to have discovered a "more practical" material among certain ceramics.

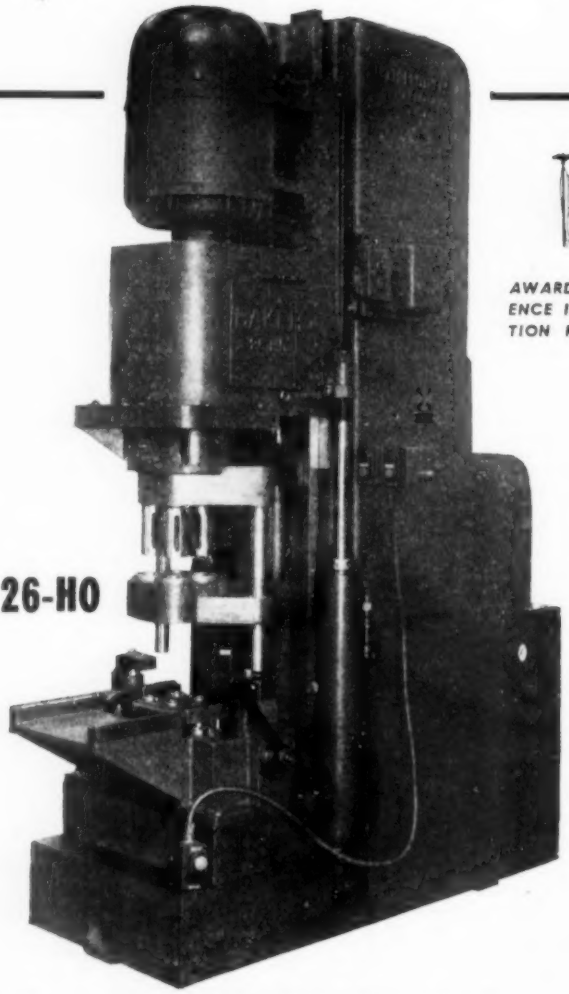
"GREENIE" She Obeys Orders

T.M. REG. U.S. PAT. OFF.

MY GOSH, GREENIE! THIS ISN'T WHAT WE MEANT WHEN WE TRANSFERRED YOU TO THIS DEPARTMENT AND TOLD YOU TO LEARN HOW TO FEATHER PROPELLERS!
DEPT. 98
PROP. DRESS-UP
GLUE
RALPH DAVIS

Another Baker

WAR WORKER



ARMY E NAVY

AWARDED FOR EXCELLENCE IN WAR PRODUCTION MARCH 20, 1943

Model 26-HO

This Hydraulic Feed Machine Performs Accurate Boring Operations In Valve Guide Holes . . . .

One of the largest manufacturers of Diesel engines is using this machine for accurate boring operations in the valve guide holes of a Diesel engine cylinder head. It is tooled complete with an extra heavy duty precision 4-spindle fixed center multiple head, mounted to the pickoff gear head on the saddle of the machine. It is also furnished with a special quick-acting fixture mounted on the base pedestal. This fixture is arranged with lower pilot bushings for lower piloting of the boring bars. Note the rigid, well-ribbed 4-bushing tool support plate.

WRITE FOR COMPLETE INFORMATION

BAKER BROTHERS, INC.

TOLEDO **OHIO**

(Continued from page 115)

Sheffield wins Machine Tool Builders production award

The Sheffield Corp., Dayton, Ohio, has won the president's trophy for the greatest increase in fourth quarter shipments of 1942 over those of the preceding quarter. Tel Berna, general manager of the National Machine Tool Builders Association, has announced.

Milton Ahlers, manager of machine tools division, Sheffield Corp., and Ray Mahlmeister, superintendent of machine shop, reading announcement of National Machine Tool Builders award.

Tops field: The company led all others in the industry with an increase of 224 percent in the value of machine tools it shipped during the year's final period. Officials of the corporation said they were particularly pleased with the showing made by their personnel because it was achieved while also establishing new highs in precision measuring instrument and gage production.

The trophy will be presented later by Walter W. Tangeman, president of the National Machine Tool Builders Association. The prize was offered originally by John S. Chaffee, former president of the Association and now vice chairman of the tools division of the War Production Board.

Precise measuring service gratis; Sheet metal firm changes name

Engineering and laboratory service through which manufacturers of mechanical parts may obtain precise readings on flatness and profile is being offered gratis by Mid-West Abrasive Co., Detroit.

Purpose: L. P. Jackson, vice president in charge of engineering, said the service is designed to assist ordnance manufacturers who have to cope with rigid government specifications on finish and tolerances and do not have measuring equipment on hand.

The Mid-West laboratory, Jackson said, is equipped to measure accurately depth of scratch down to one-tenth of a micro-inch or to determine promptly whether or not any given part is optically flat. In event a part is found to be not optically flat, the laboratory will make it flat if requested.

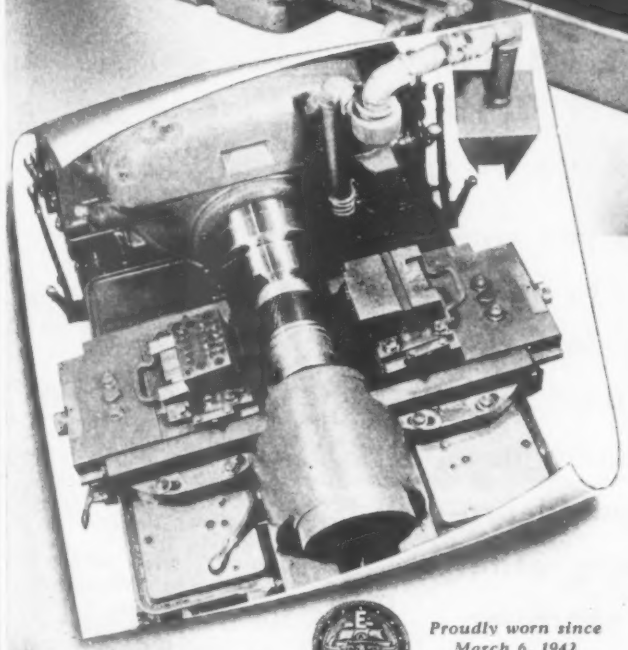
The service includes return of the part along with readings and complete technical data on the grain, grade, tool speed, coolant and pressure recommended to produce the required finish.

* *

Industrial Sheet Metal Works, Detroit, has just announced a change in its name to Industrial Equipment

(Continued on page 118)

28 TOOLS do the Job!



Machining tapered fins on aeroplane engine cylinder barrels with two banks of tools . . . on a No. 3A Duomatic Lathe. • • • •

Proudly worn since March 6, 1942

Write for complete illustrated Bulletin No. 601

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.

ENGINE · TOOL ROOM · AUTOMATIC LATHES

One of the
LARGEST ENGINEERING STAFFS IN THE COUNTRY . . . . .

. . . . . **ready to help you with any engineering task you may have—to utilize present equipment to better advantage—to design new tools, dies, fixtures for altered production routine—to make new plant layouts—to diagnose your equipment in relation to anticipated production now and later—and in many other ways bring greater efficiency to your operation.**

We shall be glad to discuss these matters with you at anytime you suggest.

ENGINEERS
DESIGNERS
CONSULTANTS

PIONEER ENGINEERING AND MANUFACTURING CO.

19645 JOHN R
DETROIT, MICH.

(Continued from page 116)

Corporation.

Established in 1929, the company is today an important manufacturer of dust collecting and spray booth equipment, ovens and ventilating systems. One of the company's developments is the Hydro-Whirl Dust Collector. The management is unchanged, it was announced.

New device tests compression yield strength of single sheet of metal

A new jig for the determination of compression yield strength in sheet metal used in aircraft has been developed. W. P. Montgomery and R. L. Templin of The Baldwin Locomotive Works are credited with conceiving the device.

Jig for testing the compression yield strength of a single thickness of metal. The device was developed by Baldwin Locomotive Works engineers.

Simplicity: This new method makes it possible to test a single thickness of sheet in compression supporting the sheet in the jig with a multiplicity of small rollers. The extensometers are attached to the edges of the sheet.

The testing of the material in single sheet form requires a smaller load and simplifies the technique of testing to a large extent. Simple and inexpensive, the Montgomery-Templin jig reduces the apparatus to its lowest terms.

It has been the custom to obtain values for compression yield in sheet metal by testing the sheets in packs. The sheets would pile up to a thickness equal to the width of this test sheet and the pack would then be supported by needle points held in a special fixture.

Cemented tungsten carbides play vital role in mass production

The development on a mass production scale of tools and dies employing cemented tungsten carbide has assisted materially in solving the problem of tungsten supplies.

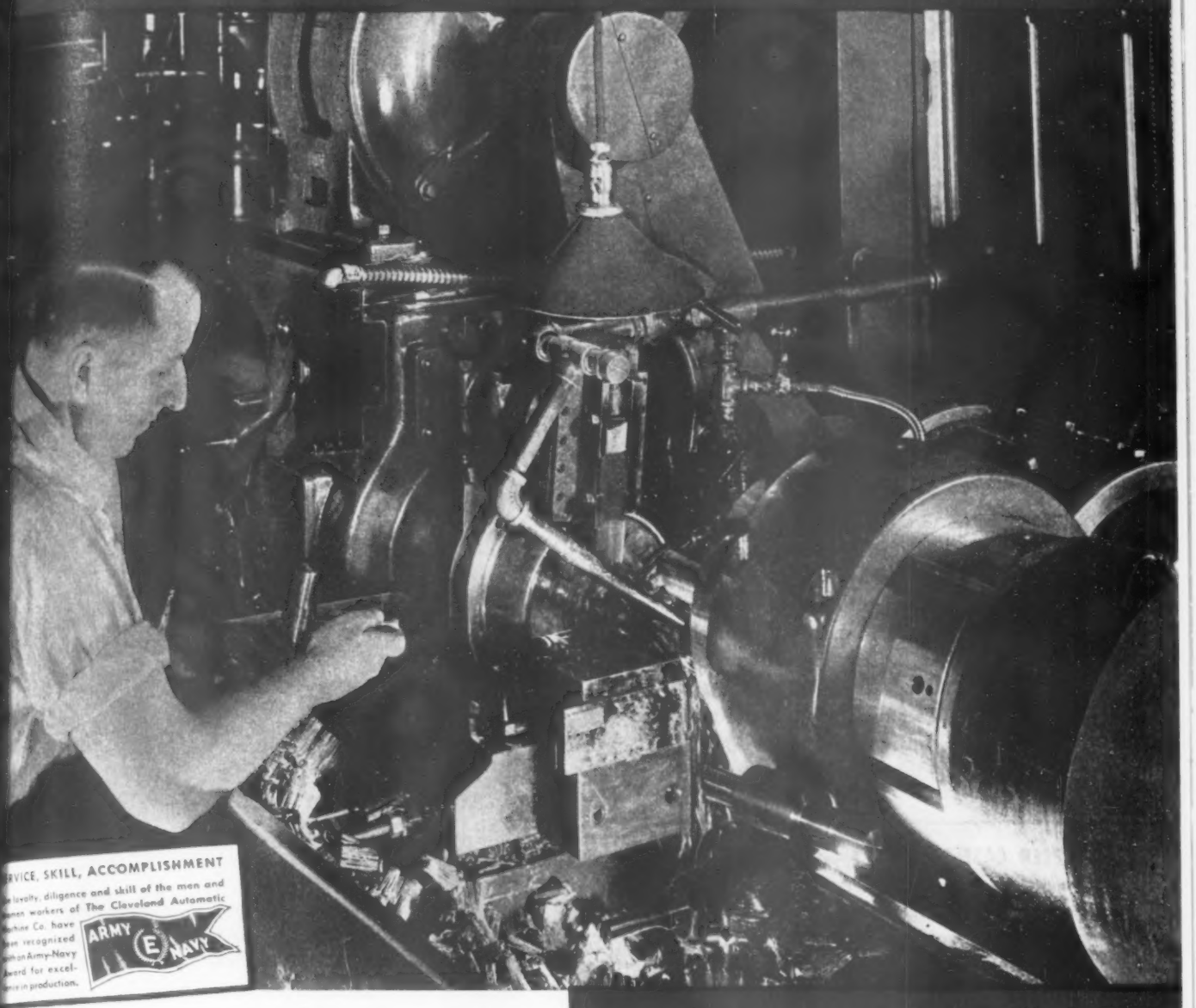
This fact was revealed recently by Adam MacKenzie, Vice President in Charge of Manufacturing, Carboloy Company, Inc., Detroit, speaking before the Ottawa section of the Canadian Institute of Mining and Metallurgy.

Production: As an example, MacKenzie pointed to the "hot press method" in which the pressing and sintering operations are carried on simultaneously, thus materially expediting the processing of cemented carbide large die nibs, etc., such as used in large shell dies.

In this process the powder is placed in a suitable and closed mold, usually of graphite. The mold and its contents

(Continued on page 120)

MICHIGAN TOOL COMPANY STEPS UP PRODUCTION OF CONE-DRIVE PINION BLANKS » » WITH USE OF NEW CLEVELAND *Single Spindle* AUTOMATICS



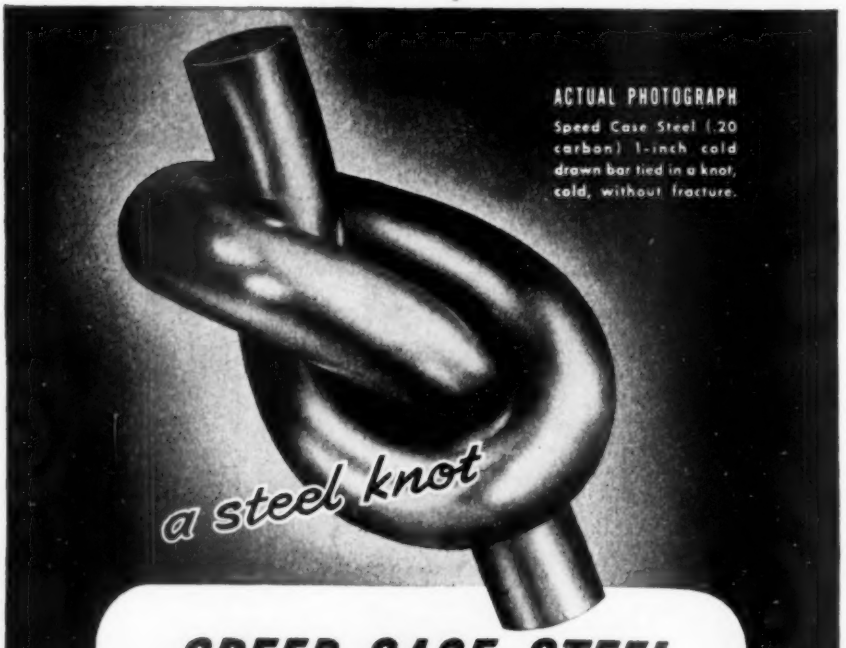
TYPICAL of small lot, short run jobs assigned to Cleveland *Single Spindle* Automatics is the production of cone-drive pinion gear blanks at Michigan Tool Company. Operations include rough turning and forming both ends. Several machines and operators on jobs similar to this can sometimes be released for other work by the use of a Cleveland. Nine times out of ten Clevelands materially increase production, reduce costs.

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 Ashland Road, Cleveland, Ohio

CHICAGO, 20 North Wacker Drive, Civic Opera Bldg. • DETROIT, 540 New Center Bldg. • NEWARK, 902 American Insurance Bldg.
CINCINNATI, 1515 American Bldg.

CUT COSTS WITH CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 1 1/16-inch to 9 1/2-inch capacities inclusive
MODEL B—Built in 1 1/16-inch to 2 1/2-inch capacities inclusive



SPEED CASE STEEL

A LOW CARBON OPEN HEARTH PRODUCT

ONE *Steel that gives you...*

1. High Speed Machining
2. Greatly Increased Tool Life
3. Smooth Finished Parts
4. High Physical Properties
5. Excellent Impact Resistance
6. Good Torsional Values
7. High Case Hardness
8. Great Core Toughness
9. Reduce Carburizing Time
10. Unusual Ductility
11. Minimum Distortion

SPEED CASE STEEL has *Physical Properties* equal to or higher than all other comparable steels... with great *DUCTILITY*... excellent *IMPACT* and *TORSIONAL* values.

WRITE US FOR DETAILS...
Our metallurgists are at your service.

BUY WAR BONDS

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MONARCH STEEL COMPANY
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THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

(Continued from page 118)

are heated to sintering temperature while sufficient pressure is imposed in one direction to overcome the forces which cause shrinking in the other two directions when a cold-pressed compact is freely heated.

The molds are ordinarily heated electrically to approximate the sintering temperature used in the cold press method. Heat may be applied indirectly from a resistance furnace or may be generated within the mold itself by resistance or by high frequency current. Suitable protection against oxidation serves to prevent undue deterioration of the mold. Pressures of 400 to 2,500 psi. are commonly used.

Another process recently developed, MacKenzie explained, is that of extrusion capable of making rods, tubes, non-symmetrical cross sections, such as angles, flats, half-rounds, ovals, etc. and in lengths not previously obtainable.

Equipment today is capable of producing cemented carbides in large and varied shapes and sizes up to a 50-pound piece, he stated.

New method speeds marking of calibrated rings

Greatly increased by war manufacture is the need for accurately calibrated rings, collars, and discs for ordnance such as machine gun mounts, sights, indexing handles and other accurately graduated parts.

This need is now being met in part by the special engraving and marking equipment designed especially for this work and installed in the plant of New Method Stamps, Inc., Detroit.

Graduated collars and rings are accurately calibrated and marked by this new type precision marking machine.

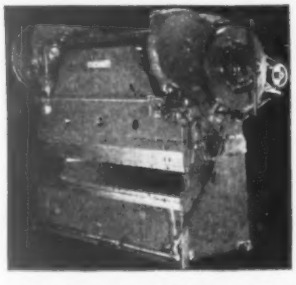
Method: As an example of this work and machinery, the piece to be marked is mounted on the spindle of the machine shown here, which is indexed by the master cam and latch mechanism according to desired spacing of graduations. The graduations are then cut to specified length between each setting of the indexing spindle by the high-speed cutter mounted on the vertical motor spindle.

Graduated parts of this type must be extremely accurate. The angular graduations must not be affected by a variation of a few thousandths in diameter. Generally, with conventional roll-

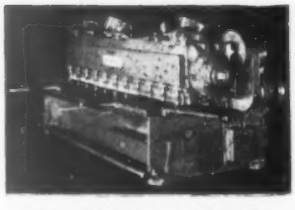
(Continued on page 122)

In 1936, The Cincinnati Shaper Company adopted the "Winged Victory" figure as a symbol for victory in production through accuracy. Today, in our minds, its significance has infinitely widened.

SHAPERS



BRAKES



SHEARS

At the end of the road lies Victory.

. . . It's "all out" production in your shop.

. . . It's "all out" production in our shop.

Together, we speed the tools for Victory.

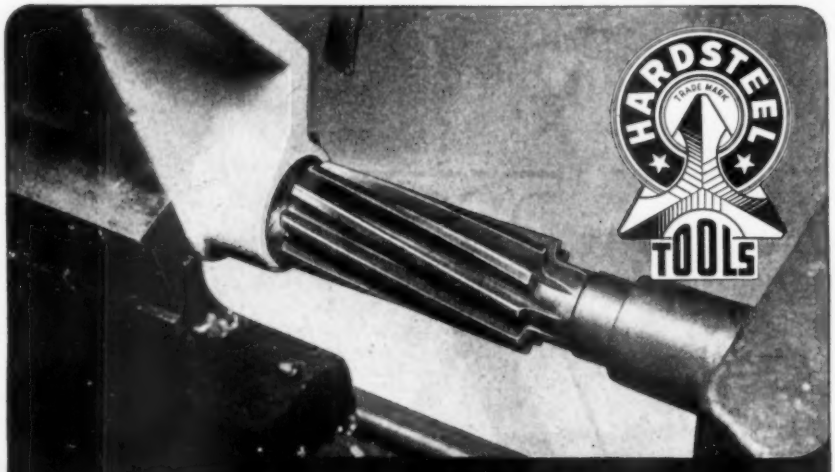
THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

YOU CAN REAM

HARD · TOUGH · ABRASIVE

ALLOYS AND PLASTICS



with HARDSTEEL REAMERS

Bomb rack hinges are made of an aluminum alloy —heat-treated for hardness yet tough to machine and tougher on tools because of the abrasive action of the metal.

A Cleveland manufacturer solved the almost impossible job of putting a blind hole 1 5/16 in. diameter and about 5 in. deep in these castings, using "HARDSTEEL" Reamers and taking off .015 in. of metal on a side while holding tolerance to .002 in.

One "HARDSTEEL" reamer has done more than 1200 to date and is still in service. Developed to drill hardened steels of Rockwell C 40 or higher, "HARDSTEEL" is now available in reamers, tool bits and special tools for working the abrasive alloy metals and plastics. Try it. Note its longer service per grind—faster cutting action because of extreme edge hardness—its ease of grinding on any wheel.

Write for "HARDSTEEL" operator's manual. It's free.

BLACK DRILL CO. • 5005 Euclid Ave., Cleveland, O.

YOU HARDEN IT—WE'LL DRILL IT

"HARDSTEEL"

DRILLS · REAMERS · TOOL BITS · SPECIAL TOOLS

(Continued from page 120)

marking devices the accuracy is dependent upon the closeness to which the diameter is held to specified sizes, and errors in graduations are cumulative.

Circles must be divided into degrees or other parts of the circle, and often again subdivided with lines of alternate lengths into even smaller subdivisions. They must then be legibly marked with numerals or letters for quick identification. Similarly, disc dials, serrated rings, notches, slots, etc., must be cut in exactly located positions.

Hard chrome used to restore worn surface plates

Another application of chrome plating recently developed is involved in a new method of salvaging worn surface plates. The method, which provides a superior surface for inspection set ups, has been announced by The Lincoln Park Tool and Gage Co., Lincoln Park, Mich.

Advantages: The process consists of reworking the plate, hard chrome plating it and then lapping it flat. Hard chrome plating produces a surface said to be longer wearing than the conventional surface plate material.

Because the chrome surface is harder and smoother, precision instruments are more easily set up and moved about, the company states. Also, chrome plating makes the surface highly resistant to rust. At present the work of resurfacing handled by Lincoln Park Tool and Gage Co., is limited to plates no larger than 18 by 24 inches.

Twelve metal fabricating industries sponsor radio morale programs

A radio program designed to build employee-morale is now sponsored by 12 major war plants in the machine tool center of Rockford, Ill. Entitled "Soldiers of Industry," the program is a tribute to the employees of its sponsors.

New Idea: The program, which lasts 30 minutes, combines news and drama. The first quarter-hour is devoted to flash news of personnel activities in each of the plants. The second portion of the program is a dramatic tribute to the workers of one of the sponsors. These dramas trace the use of the plants' principal products as they fulfill their purposes in the war effort.

In order to reach workers on every shift it is broadcast every Sunday at two P. M., with repeat shows on Monday at 9:15 P. M. and Tuesday at 6:15 A. M.

"The average factory workers — the fellow on the bench or the girl in the office — can't realize the importance of the job," John J. Dixon, creator of the program said. "He's doing the same work that he did in peacetime and can't see the connection between his job and the men on the battlefronts. Through the dramatic episodes on 'Soldiers of Industry,' we picture the production of certain items from the machine to the finished product as it is used by our fighting men. This brings home to the worker that he is responsible for making the goods that will win the war."

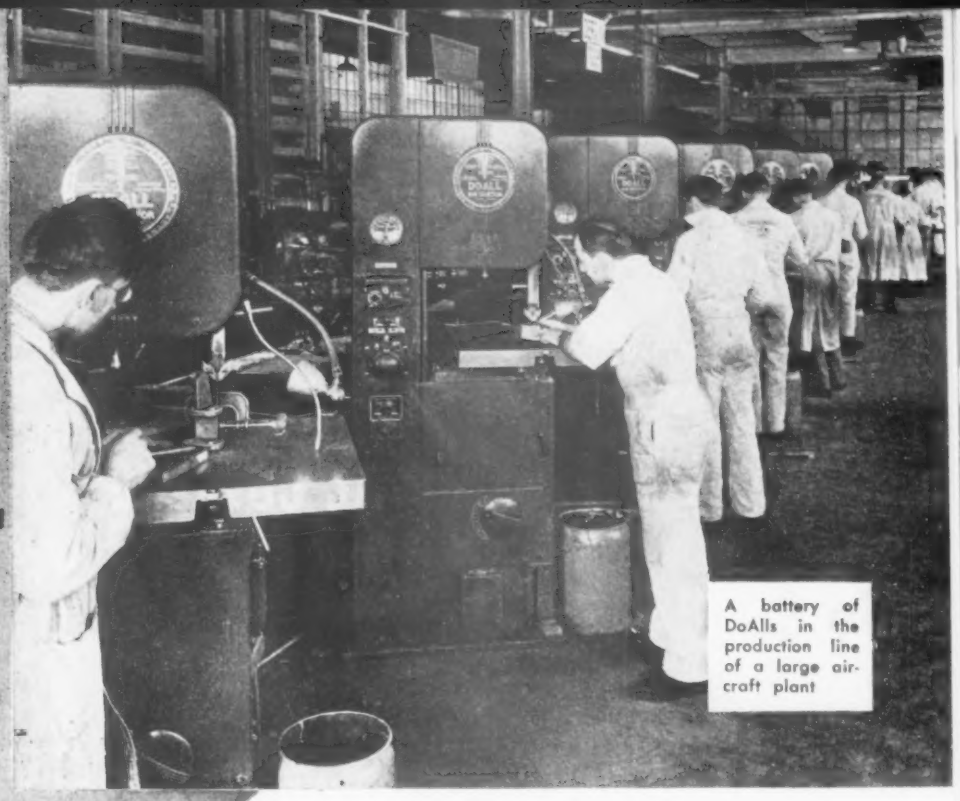
Cost of the series is pro-rated to each factory according to its size. All scripts are submitted to the local office

(Continued on page 124)

★

IT'S ALL THE SAME TO THE DoAll

SPECIAL PARTS OR 24 HOUR PRODUCTION



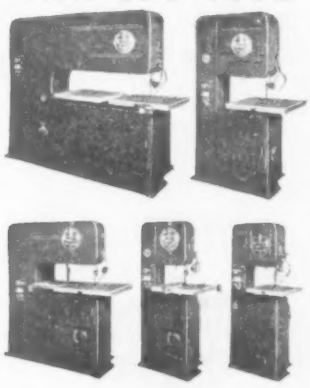
A battery of DoAlls in the production line of a large aircraft plant

● The DoAll is doing its bit—and a very big bit—wherever metals, alloys or plymetals are cut and shaped.

Steady streams of parts for guns, jeeps, planes, trucks, tanks, flow over its work table. Anything from a 2000-lb. gun slide to a 2-oz. instrument part—15-ft. channel forms, blocks a foot square, all kinds of molds, dies and liners, form tools, gauges, machine parts.

DoAll follows a straight line with precision accuracy—follows any contour design and gives a smooth finish requiring no further machining—does internal and external sawing, filing, polishing.

THE BIG FIVE



DoAll Contour Machines for rapid internal and external sawing and filing of any metal or alloy. Priced from $1,000 to $5,000, each model with motor.

FASTEST METAL CUTTING METHOD

Because of its speedy, accurate performance, a great deal of shaper, milling and lathe work is switched to the DoAll. Time schedules are whittled down to astonishing new lows. A day's work in an hour—an hour's work in ten minutes—these are typical DoAll results.

LET US SHOW YOU

A factory trained man will call with a DoAll and demonstrate many amazing metal-sawing short cuts on your own work.

WRITE FOR THIS BOOK

"DoAlls on Production", a picture story of performance in many different plants. Interesting and informative.

CONTINENTAL MACHINES, INC.

1304 S. Washington Ave., Minneapolis, Minn.

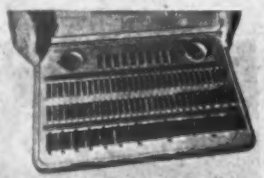
Local DoAll offices (See Telephone Directory) distribute these machines. They also sell and service DoAll Grinders, Gage Blocks, Band Saws and Files, Parts and Accessories.

Making special dies is easy and quick on the DoAll

DoAll cuts sector gears in 5 min. each. Former method 30 min.

DoALL GRINDER

Finest made for high precision surface grinding. Adaptable to wet or dry grinding.

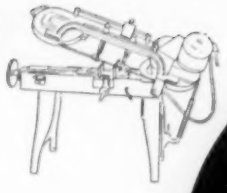


DoALL GAGE BLOCKS

81 to each set. Come in 3 accuracies:
WORKING SET, 8 millionths of an inch $295.00
INSPECTION SET 4 millionths of an inch $390.00
LABORATORY SET, 2 millionths of an inch Price on application.

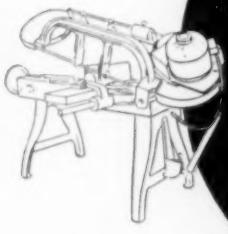
No. 5

Ideal tool room size.



No. 8

Popular all around production Saw.



Wells

Fast-Rugged

METAL CUTTING BAND SAWS

No. 9

General Foundry Saw.

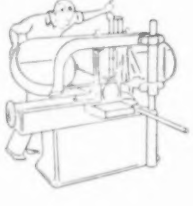
WELLS METAL CUTTING BAND SAWS are engineered and designed for dependable long service in metal cutting efficiency, meeting the exacting requirements of present day demands on industry.

Whatever your metal cutting jobs are, call your distributor or write direct.

Wells Has Established Leadership

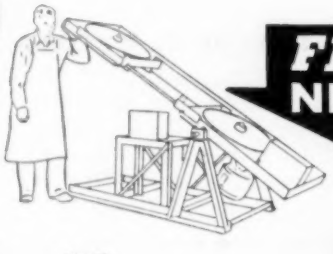
No. 12

Heavy duty production Saw.



No. 20

Designed for cutting risers off propeller blades.



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Wells METAL CUTTING BAND SAWS

1212 MONROE ST. • THREE RIVERS, MICHIGAN

(Continued from page 122)

of the Chicago Ordnance District for approval.

Participating industries are: American Cabinet Hardware Corp.; Cotta Transmission Corp.; George D. Roper Corp.; Greenlee Bros. & Co.; Ingersoll Milling Machine Co.; Mattison Machine Works; Mechanics Universal Joint Co.; National Lock Co.; Rockford Machine Tool Co.; Sundstrand Machine Tool Co.; Woodward Governor Co.; and the Rockford Drilling Machine Co.

South gets another big industry in Bell-operated bomber plant

Rivaling in size Ford's famed Willow Run, one of the largest and most modern aircraft manufacturing plants is nearing completion at Marietta, 15 miles from Atlanta, Georgia.

Little news of this vast mass-manufacturing enterprise has filtered out, but at least a part of the story can be told because, as an Army representative observed, "You can't hide an elephant in a cotton patch!"

Experience: The plant will be operated by Bell Aircraft Corp., builders of the Army's cannon-carrying Airacobra fighter. This experienced aircraft manufacturer will produce long-range, multi-engined bombers of a closely-guarded design for the Army Air Forces.

Though the plant appears almost ready for occupancy, there still remains a substantial period which must be devoted to machinery installation and the integrating and training of thousands of workers before actual fabrication of planes will begin, Bell has pointed out.

In making clear the fact that "bombers will not begin rolling out the front door next week," Bell has stated that since the plane is of an entirely new design, there will follow the usual period of testing and development of the prototype before the signal for all-out production is given.

Obviously anxious to avoid the premature publicity that came home to roost on Henry Ford's doorstep, Larry Bell, president of Bell Aircraft, stated, "Located in an area which heretofore has had no aircraft manufacturing experience, we could not expect to find thousands of people skilled in airplane manufacturing ready to go to work. Therefore, we had to plan the production ability of this plant with the most modern simplified methods of aircraft manufacturing conceivable today."

The plant is heavily insulated and windowless throughout, and the temperature can be controlled within a small range to insure precise work with metals.

The plant production schedule and capacity are secret, the Army has announced.

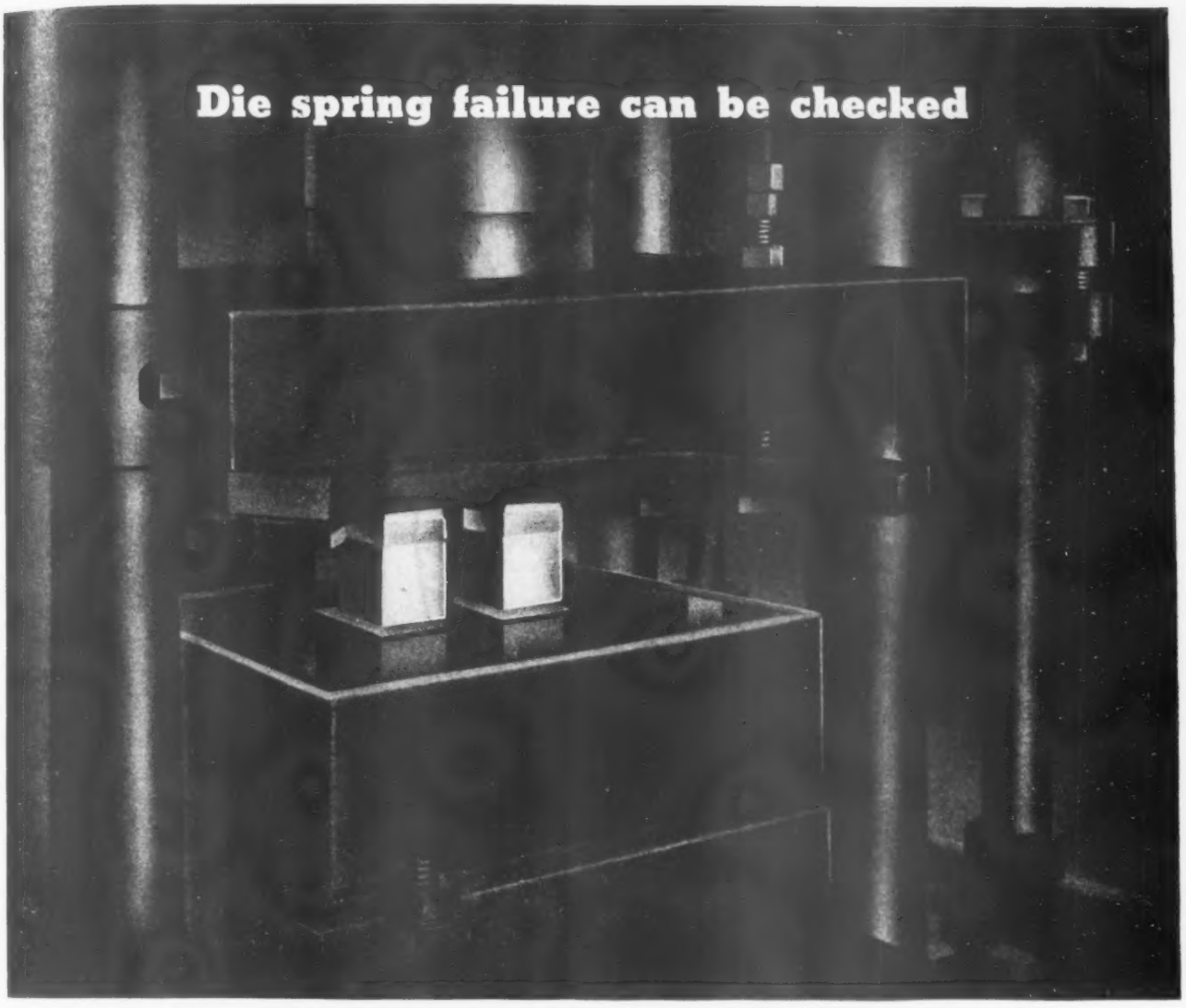
Central Aircraft Council launched to expedite aircraft output

To expedite aircraft manufacture through the exchange of technical "know-how", a Central Aircraft Council with headquarters in Detroit has been established.

Embracing leading aircraft manufacturing concerns in the Central States, the new Council will sponsor technical activities paralleling those of the West and East Coast Aircraft Councils.

(Continued on page 126)

Die spring failure can be checked



Information supplied by an Industrial Publication

A recent investigation of die spring breakage developed the following prominent causes:

1. Hydrogen embrittlement resulting from plating, pickling or cleaning.
2. Incorrect die design.
3. Incorrect spring size.
4. Speed of compression cycle.
5. Poor quality of wire.

There are, fortunately, remedies for all these conditions. Hydrogen embrittlement can be corrected by heating plated springs to about 450°F. and air cooling.

Faults in die design usually consist of either insufficient or too great clearance between the outside diameter of the spring and the guide hole. The clearance should be such that the spring operates freely, but has no chance to buckle.

Care should be taken in selecting springs to see that they are properly designed for both length of compression stroke and speed of compression. If springs are repeatedly compressed too close to their solid height, quick failure will result. The same is true where the rapidity of compression is too great.

It seems obvious that the quality of the spring wire should be commensurate with the job. Cheap wire should be avoided because of defects that are bound to cause trouble, especially when springs are plated.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

EUREKA

TOOL STEEL ELECTRODES SAVE

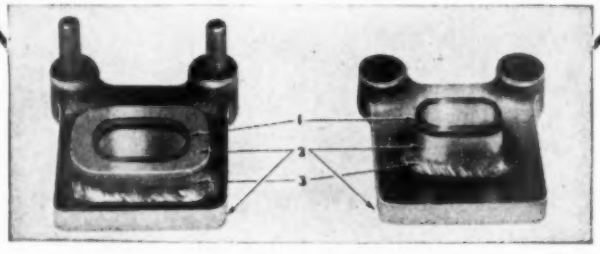
tons of vital TOOL STEEL

Every day, tons of critical tool and die steels are being saved for vital war needs by the use of EUREKA Electrodes for the welding of worn or fractured dies. These EUREKA Electrodes can be used to effect maintenance repairs in *your* shop on oil, air and water hardening and hot working steels.

EUREKA Electrodes also save a vast amount of tool and die steels when used for the composite construction of dies, by welding on the working edges of *less* expensive and easily procurable carbon steels.

If you really want to save tool and die steels in the construction or repair of your dies it will pay you to write for our 16-page catalogue today. It describes in detail the use of the complete line of EUREKA Tool Steel Electrodes.

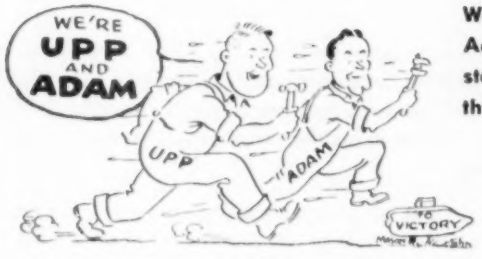
HERE IS HOW IT HELPS THE WAR EFFORT



★ Illustration shows typical fabricated dies. Arrows 1 point out tool steel electrode deposits used as cutting edges, neither of which are over $\frac{3}{16}$ inch thick. Arrows 2 indicate machine steel used instead of tool steel to lower die composition cost, and 3 refers to construction welds made of mild steel rod to hold die parts together.

★ *Write for information on "SUTTONIZING" our welding process for the reclamation of high speed steel cutting tools.* ★

WELDING EQUIPMENT & SUPPLY CO.
222 LEIB STREET • DETROIT, MICHIGAN



Why don't you be Upp and Adam too and conserve tool steel for Uncle Sam — mail this coupon to us right now!

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Gentlemen: Please send us complete information about "Suttonizing."

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City.....State.....

(Continued from page 124)

Top Men: Serving as a top committee to guide Council activities will be Walter F. Wagner, executive, Ford Motor Co.; H. E. Blythe, vice president, Goodyear Aircraft; G. T. Christopher, Packard Motor Car Co.; M. L. Peale, vice president, Republic Aviation; E. B. Meissner, president, St. Louis Aircraft; A. T. Colwell, vice president, Thompson Products; C. B. Bleicher, vice president, Chrysler Corp., and O. E. Hunt, vice president, General Motors Corp. Ernest R. Breech, president, Bendix Aviation Corp., will serve as Chairman.

All members of the Automotive Council for War Production holding prime aircraft contracts automatically become members of the Central Aircraft Council.

The new Council will cooperate with the west and east groups on problems of general character, it was said at the Detroit headquarters.

Carbide tipped reamer prices reduced, Wendt-Sonis announces

Prices on W-S standard reamers have been reduced 20 per cent, the Wendt-Sonis Co., Hannibal, Mo., has announced. The price reduction became effective April 1.

This price reduction applies to the company's entire line of both straight and tapered shank, carbide-tipped reamers ranging in size from .25-inch through 1.5-inches.

"These lower prices," Alec Sonis, company general manager, stated, "are the result of our greatly increased volume on reamers coupled with the recent acquisition of new production facilities."

Motor Manufacturing Memos: Gage standardization sought

Gaging Standards: In a move to unify gaging practices employed in inspection of precision parts, the Automotive Council for War Production has laid the ground work for a standardization program to be carried out by the American Standards Association.

The proposal, made last month, has accelerated the work of developing a new standard for specifying cylindrical fits and tolerance and methods of gaging inspection and gage control.

At an Automotive Council meeting of 16 representatives from five principal automotive manufacturing concerns, it was agreed that there is an urgent need for such a standard, due to the high degree of precision and maximum interchangeability of close fitting parts required in most war products.

"Such a standard is needed badly in American industrial plants and arsenals," declared a Council staff man engaged in coordinating the work. "It would be useful as a basic reference for changes in design and tooling of war products and in new war production jobs. It would be just as valuable in post war manufacture."

"The tolerances demanded in war work," he added, "have impressed on the industry's engineers the need for an acceptable system of cylindrical fits more complete than that given in the Tentative American Standard B4a-1925 and that this standard should be

(Continued on page 128)

A Practical Solution for many Finishing Problems

In *your* plant—right now—there are dozens of sanding, polishing and finishing operations for which this Delta Abrasive Finishing Machine is ideal. Here's why: It is husky enough to stand the grind of the production line. Its advanced design permits quick, accurate adjustments for a large variety of jobs. It is light enough to be easily moved around to just where you need it, and the price is surprisingly low. Find out for yourself why thousands of shops have found it so efficient for finning, finishing and surfacing metal and plastic parts.

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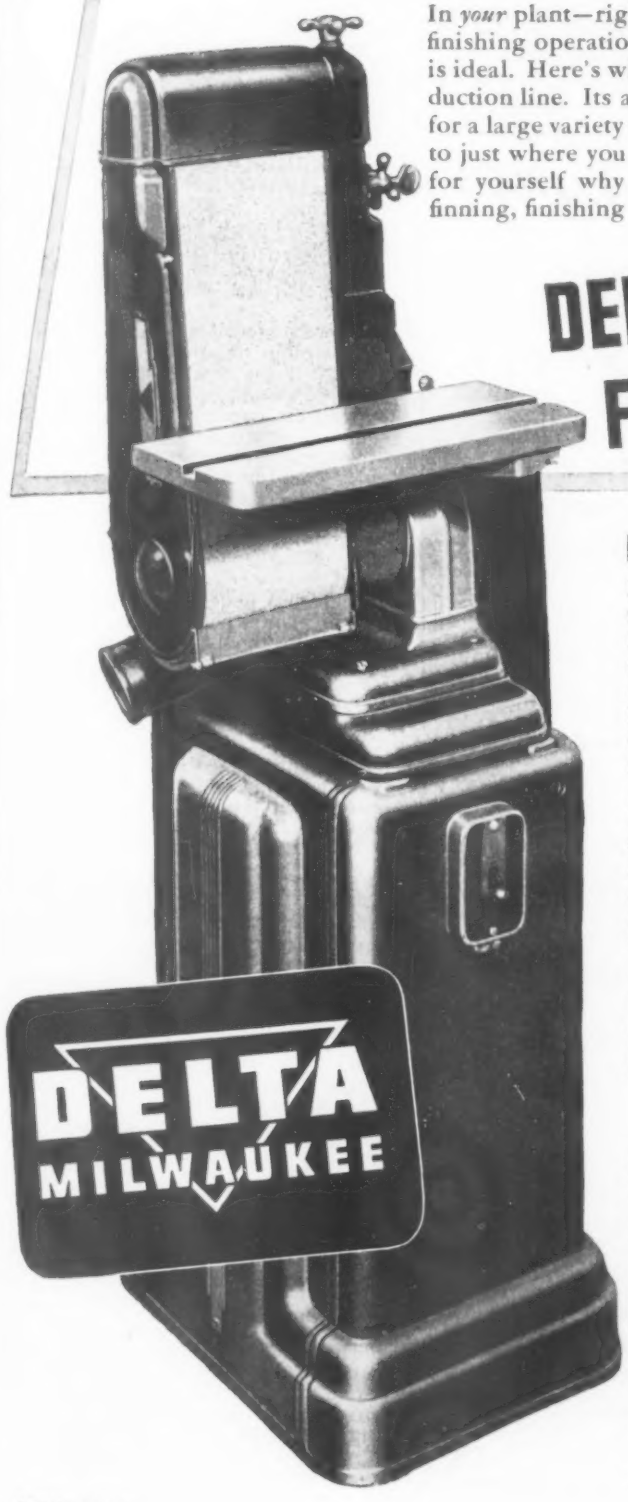

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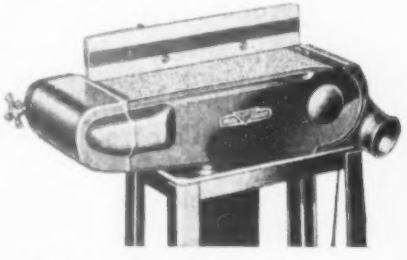

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Both turn out parts but one produces ***more accurate*** work — in ***larger quantities*** — at ***lower cost*** and for a ***longer period of time*** before requiring attention.

The element of more satisfactory performance in the superior tool is generally due to the broad, practical experience of its producer—A PLUS FACTOR, as compared to ordinary tools, which manufacturers have a right to demand.

Today, when plants mushroom into being and new, comparatively unknown organizations seek contracts involving great responsibility, it behooves those placing business to protect their interests by careful investigation.

We welcome such investigation and "will stand or fall" in our efforts to get business — upon past accomplishments.

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Tools·Dies·Jigs·Fixtures·Special Machinery

(Continued from page 126)

supplemented by gage specifications.

The work: The actual development is being conducted by the American Standards Association, under the direction of a special wartime committee, embracing representative American industries. The program has been undertaken with the cooperation of the War Production Board.

The ASA committee will submit its recommendations for approval within five or six months, it is believed.

The problem presented by the lack of an acceptable gage standard was explained by a representative of the inspection department of a concern engaged in aircraft engine manufacture.

In this instance, the necessity of making more than 40,000 inspections per engine, and maintaining in use more than 100,000 gages, requires periodic checking of gages at a rate of 5,000 daily.

Search for a general standard specifying what tolerances should be given the gagemaker for these instruments, how these gagemaker's tolerances should be located relative to the limits of the part, and to what extent the gages should be permitted to wear, has revealed that no such American standard exists.

Interchangeability: Auto engineers interested in this project have pointed out that in the absence of an American standard for gagemaker's tolerance and permissible gage wear, it has become common practice for the inspection department to translate the part limits given on a drawing into gaging practice which is expected to result in the desired performance of the mating parts in assembly.

In the absence of standard gaging practice, this translating of the drawing limits is done in different ways in several plants making the same parts. As a result, the fit of parts made to one set of gages might give the correct fit when assembled to their mating parts, while parts made to another set of gages might not give a satisfactory fit.

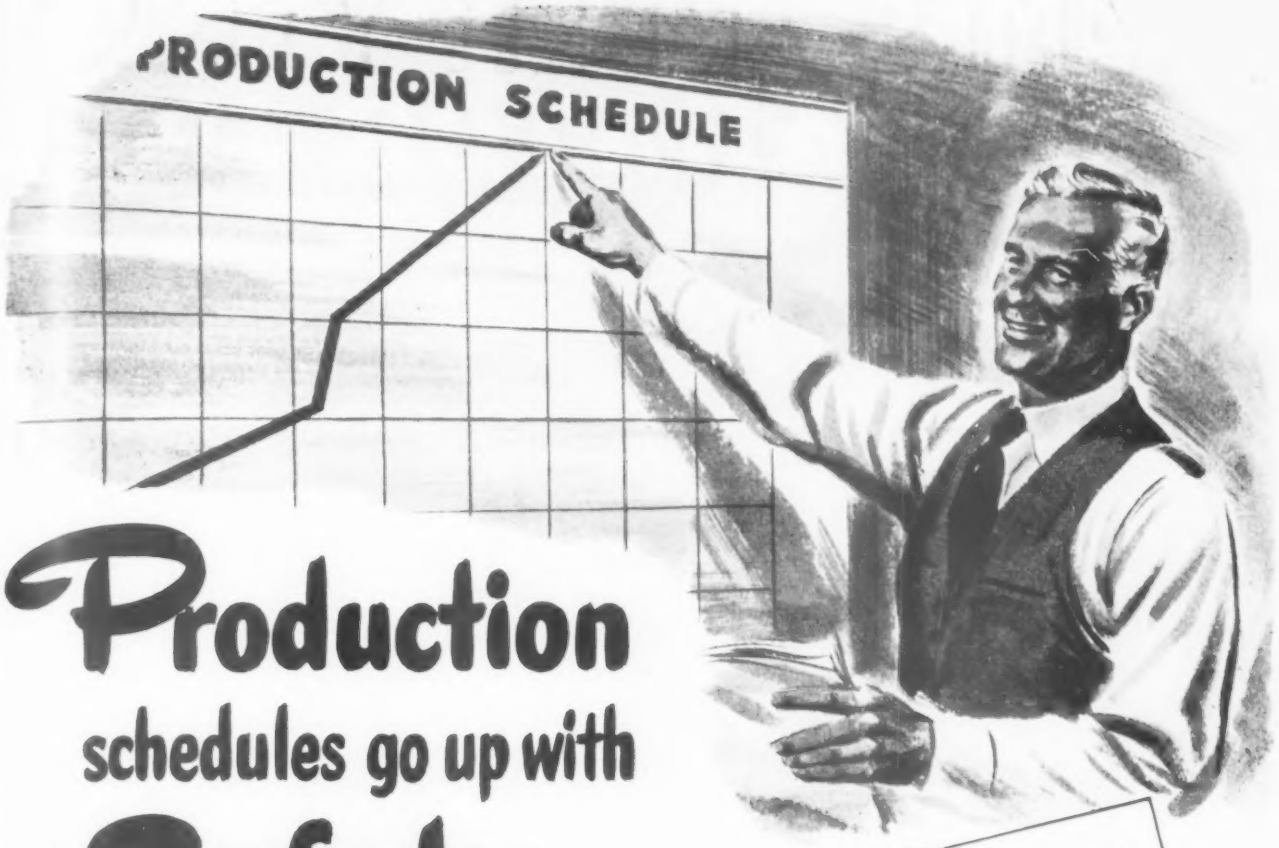
Thus, the same drawing limits, differently interpreted in terms of gaging practice, will lead to lack of interchangeability and bad fits, a number of engineers have pointed out.

* *

First forging produced in Chevrolet's aluminum forge plant was for a variable-pitch propeller. Shown is one of four 35,000-pound hammers in the plant.

Chevrolet: Steel was once the auto industry's chief stock-in-trade; but war has changed that. Today the industry is one of the prime consumers and fabricators of aluminum. That this light weight material will enjoy widespread use in post war auto manufacture is

(Concluded on page 131)



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Safety Grinders and Grinding Wheels are accepted for their continuous and dependable operation over a long period of high-speed production time.

If facing an increased production problem, outline your specific situation, and we will tell you whether we can help you. Wheels for your trial and approval will be gladly sent.

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PORTABLE GRINDERS
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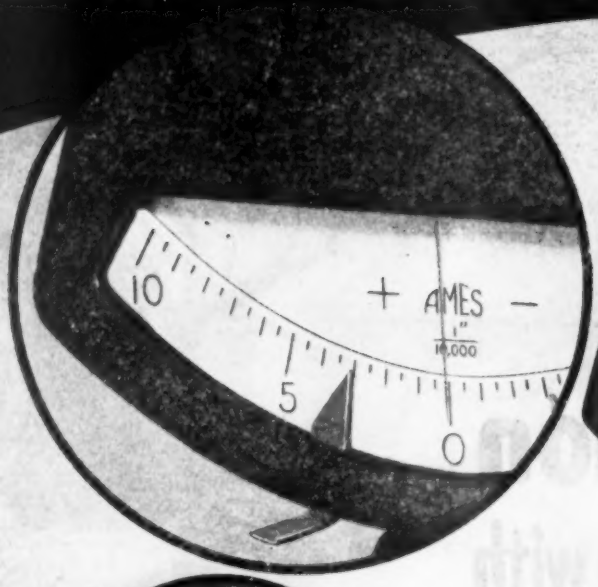
MANUFACTURERS OF SAFETY MOTOR DRIVEN PORTABLE GRINDERS, SAFETY RITE-SPEED GRINDERS, GRINDING WHEELS FOR EVERY PURPOSE, INCLUDING THE FAMOUS "SAFETY GRIP-LOK GRINDING WHEELS"

AMES COMPARATOR No. 26



...e fan shaped indi-
...ator has a total spin-
...le travel of 2/1000",
...iving a measuring
...apacity of 1/1000"
...lus and 1/1000"
...inus from zero. With-
... this limited range
...e accuracy is held
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...iamond Point re-
...uces wear to a min-
...num, giving thou-
...ands of successive
...ccurate readings.

This precision built Comparator stands solidly on a large diameter base and is heavily constructed to eliminate all spring. It is intended for use in making comparisons of duplicate parts for size and will indicate the most minute variations on the dial, with ability to give repeat readings. The cast iron base supports the steel upright column, which has a rack for up and down adjustment of the indicator. The adjustable stop assembly helps to locate work on the hardened and ground anvil.

SPECIFICATIONS

Total height 15". Base diameter 11". Total measuring capacity 6". Indicator total range .025". Distance from contact to front of Post 3½". Anvils 2⅛" x 3¼". Special anvils to order. Diamond contact point. Light pressure. Approximate weight 40 pounds.

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(Concluded from page 120)

the growing consensus among a number of the industry's younger engineers.

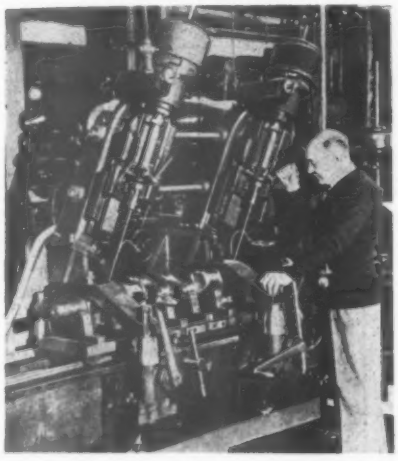
An outstanding example of the motor maker's growing facilities for aluminum fabrication is a new aluminum forge plant that will make Chevrolet one of the largest suppliers of aluminum forgings in America.

Capacity: With a peak capacity of millions of pounds of forgings annually, the new forge will supply aircraft and aircraft engine builders in addition to the automobile concern's own aviation engine plants.

Production began last month with the manufacture of aluminum propeller blades and propeller piston forgings. Main crankcase sections, pistons and other aviation forgings for the Chevrolet-built Pratt & Whitney engine are already in production at another Chevrolet forge plant and requirements to meet increased schedules will be supplied by the new forge.

Among the special equipment installed in the new forge are four 35,000-pound steam hammers, among the largest ever built. Other huge hammers will augment the production of the four giants. Also installed is a press capable of exerting 6,000,000-pounds pressure.

* *



With an engine lathe bed, two standard drill presses, and a shop-built fixture Hudson engineers devised this deep-hole driller.

Hudson: Here is a story of initiative and imagination in the conversion of existing machinery to get war products rolling. The scene is Hudson Motor Company's main plant in Detroit.

The goods must be delivered, and instead of sitting back and waiting for hard pressed machine tool manufacturers to build special purpose machines, Hudson engineers put their heads together and came up with one of the most original machine tool combinations.

Operation: Using the parts of three standard-type machines — a former engine lathe bed, and two drill press heads with the addition of a shop-built fixture — they created a bottleneck-breaking special purpose deep hole driller.

The device is used for deep hole drilling of the forced-feed lubrication oil holes through the webs and crank pin of the big crankshaft of the Hudson-built Invader engine for the Navy.

(Army-Navy "E" Awards on page 196)

TO PLANT OFFICIALS CONCERNED WITH INCREASING WAR PRODUCTION...

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LATEST *Complete* INFORMATION ON PRECISION GAGES, JIGS, FIXTURES and DIES...

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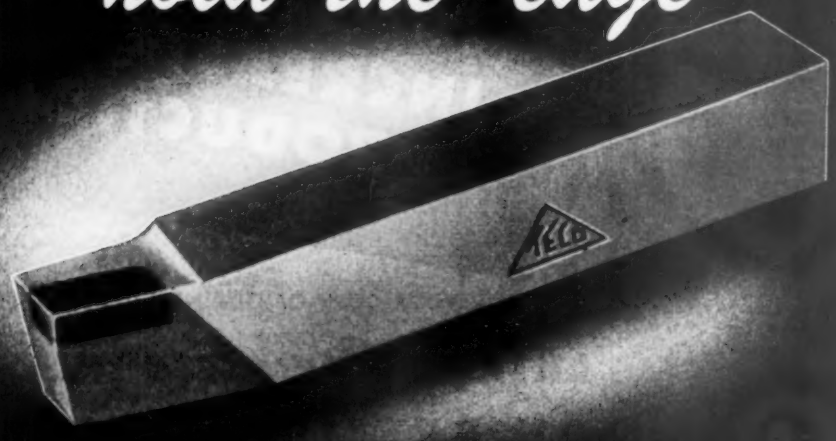

for *high speed* TURNING, BORING and FACING

MOST carbide tools look alike because they are made to similar standard shapes and sizes. But once they get on your machines, production tells a different story . . . a difference based upon the quality of the carbide itself.

Rigidly controlled hardness, density and uniformity enable TECO Carbides to hold cutting edges and maintain accurate tolerances for longer runs, producing more pieces between grinds. You reduce waste time for retooling, getting more productive hours out of your machines.

Try a run with TECO Carbide Tools and let the results speak for themselves. All standard styles, sizes and grades for most machining needs. Send details of your requirements.

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JAY A. BONWIT

Washington Correspondent for
THE TOOL ENGINEER

● CMP is having severe growing pains, but two facts are stressed by War Production Board Officials — the first, that the Controlled Materials Plan is definitely the system under which producers will operate, and the second, that PRP will supply the "underpinning" to bolster the new plan until industry is fully conversant with it.

No major changes in the plan are contemplated, although numerous adjustments have been made and will continue to be made until CMP becomes fully operative, when experience may dictate certain changes in the plan.

The major accomplishment under CMP is the compulsion on the part of the procurement agencies — Army, Navy, Maritime, and the other "claimant agencies" — to submit schedules of their requirements. This will serve to stabilize the flow of materials and to eliminate the previous conditions under which priorities were continually inflated to insure delivery of an item after industry had scheduled its production in accordance with order boards.

Success of the plan will depend on whether sufficient materials exist to meet the tonnage of the allotments issued — whether supply and demand are brought into balance. This is an administrative function, and WPB officials maintain that they are fully able to manage this supply problem.

Difficulties of the automotive industry in operating under CMP are being ironed out. The plan will evoke a number of complaints, but with PRP still in operation, no serious interruption to production is likely to develop either on the part of large producers or smaller industry.

* * *

Production problems in Washington are taking on a highly political aspect. The issues of the 1944 Presidential campaign are being established. Much of the discussion on absenteeism is traceable to this factor, as little objective study or analysis has been made on this subject.

However, as the rate of withdrawals of men from industry through Selective Service — 400,000 men a month — continues to drain workmen from the pool of labor, manpower will become an increasingly difficult problem. It is generally assumed that by summer, "hoarded" labor will be absorbed, and industry will begin scraping the bottom of the barrel. At that time more specific steps will be necessary.

A National Service Law permitting the Government to further control labor is considered inevitable.

* * *

Reorganization of the Division of Civilian Supply is considered necessary so that this agency will have equal weight with other "claimants" for allocations of raw materials and manpower. As a subsidiary unit under WPB, Civilian Supply has not been able to approach the War Manpower Commission with any degree of authority. At the same time, the voice of civilian claimants has not been particularly effective in assuring output of required civilian items.

The difficulty has not been so much in obtaining allocation of materials. Civilian programs have been approved by WPB, but there has been no Governmental authority to insure producers will produce up to the approved quotas.

The situation is now clearly the reverse of what it was early in 1942. At that time, stress was placed on conversion of civilian industry to war pro-

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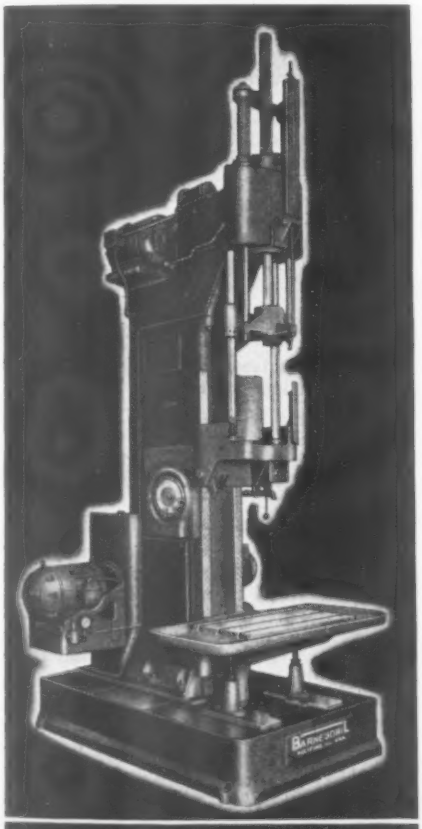
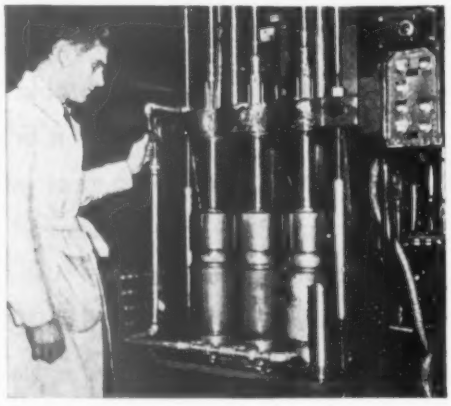


BARNESDRILL No. 307 Standard Honing Machine . . . adaptable to many jobs.

HOW *one* BARNESDRILL HONING MACHINE CAN FIT *three* DIFFERENT HONING NEEDS . . .

If you have any one of these three honing problems, the BARNESDRILL No. 307 Honing Machine can be tooled to fit your needs. Here is a machine with a standard basic design that permits a wide variety of tooling set-ups to fit different individual requirements.

FREE HONING DATA:
Write for free copy of Bulletin No. T-148 containing facts on honing process and BARNESDRILL Honing Machines.



BARNESDRILL *Honer equipped with 3-spindle auxiliary head, honing three hydraulic landing gear cylinders*

(1) FOR HONING ONE BORE AT A TIME
This No. 307 Honing Machine can be used as a single-spindle machine with stationary fixture for honing one cylinder at a time.

(2) FOR MEDIUM PRODUCTION
If your production requirements are moderate, the machine can be provided with an indexing fixture using one or more stations, which permits loading while machining.

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Where high production is required, this machine can be equipped with multi-spindles for honing two or more bores simultaneously.

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DON'T LET THE *Gremlins* **GET YOU**

With this Amazing TRIG-EASY CHART every man whose work requires a solution of problems involving angles can save his time and time for those who must wait for calculation — and eliminates all errors through use of wrong equations.

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Machine Shop; Tool Die; Jig Bore; Patterns; Layout; Inspection, Drafting. On every job where angles and dimensions are different. Speed production through education of Personnel.

Makes TRIGONOMETRY Easy

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You have 40 Trigonometric Equations at your finger-tips. TRIG-EASY pays for itself every time it is used. It is a handy vest or shirt pocket size, grease-proof and sturdy to resist moisture and dirt.

Send only 50c for your TRIG-EASY with complete instructions and MONEY-BACK GUARANTEE.

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QUANTITY DISCOUNTS TO INDUSTRIAL FIRMS

(Continued from preceding page)

duction. The problem now is in maintaining output of such civilian goods essentials as is necessary for a sound "minimum" economy. This concept should not be confused with the idea of the so-called "bedrock" economy. A sound economy takes into account the current phase of the war, with a certain amount of latitude and even comfort for the civilian. The "bedrock" concept is the minimum that the economy could be squeezed down to, consistent with health and safety.

* * *

Trend cutting into the backlog of machine tool builders' orders is continuing. WPB officials have expressed their concern over this situation, with indications that contracts will be diverted to the tool building industry to make use of their facilities and skilled labor.

The order boards of the machine tool industry are still impressive, but it is clearly apparent that war industry is fairly well tooled up.

* * *

Most recent reorganization of WPB has resulted in centralizing all authority over operations under WPB Executive Vice Chairman Charles E. Wilson, who has designated the two men of his personal choice as his key executives on production phases.

Donald Davis, Operations Vice Chairman, and Ralph J. Cordiner, Vice Chairman, were brought into WPB by Wilson. J. A. Krug, who has been given the key post of Program Vice Chairman — title formerly held by Ferdinand Eberstadt — is a hard-hitting Government man. He has made a reputation of being a man who will listen to reason, but who cannot be "pushed around". Fourth of the operating Vice Chairmen in the reorganized WPB is William L. Batt, who will take care of foreign requirements.

The Smaller War Plants Corporation operations have been divorced from the WPB organization to give Colonel Robert Wood Johnson a greater degree of action. There is no rift between the smaller war plants group and WPB, but the change was considered expedient.

* * *

Recent actions of significance to the metal cutting industry were as follows:

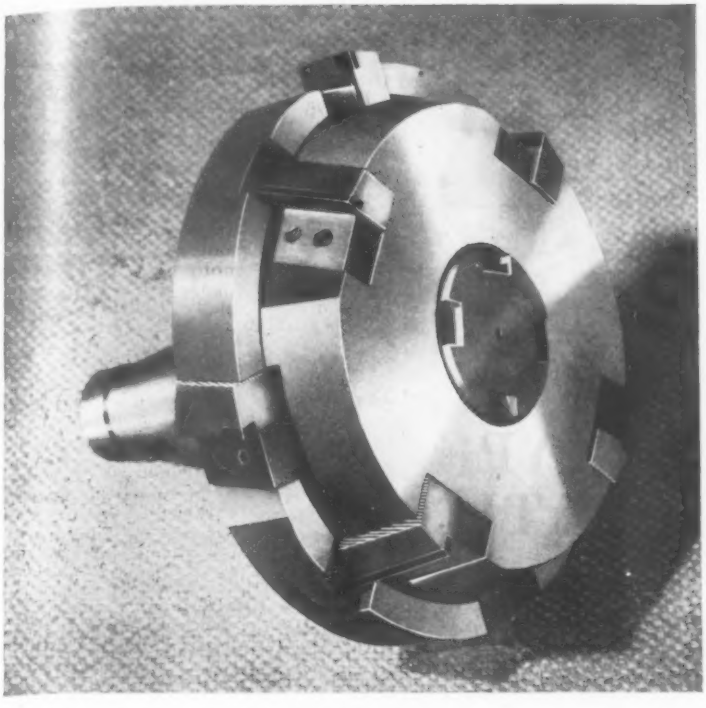
February 25 . . . WPB Director General for Operations issued Appendix X to Schedule IV of Limitation Order L-157, as amended, further curtailing the number of heavy forged hand tools which may be manufactured.

February 25 . . . National Emergency specifications for structural steel shapes, steel axles and forgings, mechanical steel tubing, and rails and track accessories, issued to limit the manufacture of steel mill products to the minimum number of varieties which will satisfy current needs.

March 1 . . . WPB Tools Division announced the value of 26,000 new machine tool units shipped during January was $117,432,000, a reduction of 11 percent from the December figure of $131,960,000. The backlog of orders shows an 8.1 percent drop in value from the December figure. Average time re-

(Concluded on page 136)

Aircraft Manufacturer Mills Duralumin



at

3700 RPM

with this special cemented carbide tipped cutter

The newest method of milling aluminum alloys calls for running the cutter faster than most grinding wheels. Such high spindle speeds greatly increase the strain on the cutter. This makes it even more important that the cutter be properly designed and made.

The two step milling cutter shown above was manufactured by Carbide Fabricators to meet the requirements of an aircraft manufacturer. It is used for milling duralumin forgings and is run at 3700 revolutions per minute. It is nine and one half inches in diameter which gives it a surface speed of 8800 feet per minute. Feed is 59.2 inches per minute. This is one of many cutters manufactured by Carbide Fabricators to meet similar demands for cemented carbide tipped tools for heavy service.

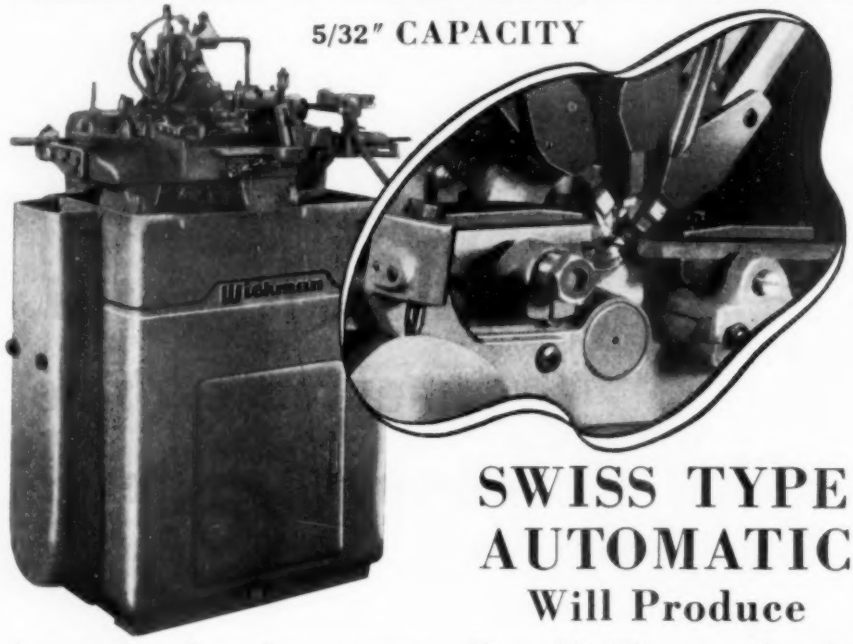
There are many places in YOUR production where specially designed cemented carbide tipped tools would mean faster production . . . greater accuracy . . . longer tool life . . . lowered cost. For details on a particular job, send a set of blueprints to Carbide Fabricators. Complete information, including prices, will be furnished promptly.

CF Carbide Fabricators Co. ROYAL OAK MICHIGAN

MFRS. OF STANDARD AND SPECIAL CEMENTED CARBIDE TIPPED TOOLS

THE NEW WICKMAN No. 1

5/32" CAPACITY



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Will Produce

Amazingly Accurate Small Parts Such AS THESE

The parts shown greatly enlarged at the right were produced in one operation by the new Wickman No. 1 High Precision Swiss-type Automatic. This new machine employs five cam actuated radial tools and a cam controlled sliding headstock that feeds the bar stock past the tools.

By a combination of tool and headstock movements any form can be generated by single point tools having both lateral and radial micrometer adjustments. Limits of ±.0002 and better can be held on production work. Write today for complete information.

PART—1/8" LONG, 6 diameters, 2 tapers, 2 pivots between .004" and .050". Finished ready for burnishing.
MATERIAL—High carbon pinion steel.
PRODUCTION—80 per hour.
TOLERANCE—±.00015".
FINISH—15 to 20 Micro-inches.

PART—7/16" LONG, 6 diameters, 1 pivot, 2 undercuts and thread between .027" and .041". Finished complete.
MATERIAL—High carbon pinion steel.
PRODUCTION—120 per hour.
TOLERANCE—turned ±.0002", thread P.D. ±.001".
FINISH—15 to 25 Micro-inches.

WICKMAN HIGH PRECISION AUTOMATIC

SWISS TYPE

THE Wickman CORPORATION

15535 WOODROW WILSON
DETROIT, MICHIGAN

(Continued from page 134)

quired to complete unfilled orders was 6.8 months at the end of January, as against 6.5 months at the end of December.

March 3 . . . CMP Regulation No. 7 issued, providing for a single standard form of certification which may be used to validate any delivery order under the Controlled Materials Plan.

March 4 . . . Copper Order M-9-a amended to place the control of warehouse sales of brass and wire mill products entirely under CMP Regulation No. 4.

March 4 . . . Production of all air-cooled engines, except for aircraft and motorcycle propulsion, is controlled by Limitation Order L-254, which limits the number of engine models to be produced.

March 5 . . . Steel plate production during February, according to a WPB announcement, reached a new high daily rate, with average daily shipments announced as 38,285 net tons.

March 8 . . . Intended to provide a better distribution of quartz crystals, General Conservation Order M-146 has been amended further tightening controls over use, fabrication and delivery of quartz crystals.

March 9 . . . Certain restrictions of M-39 covering the use of cobalt were relaxed with issuance of an amendment to the order, placing cobalt on a straight allocation basis.

March 9 . . . Interpretation No. 1 to Controlled Materials Plan Regulation No. 1 issued to clarify provisions of the regulation which prohibits producers of controlled materials from discriminating between customers in rejecting or accepting orders which are filed later than the prescribed time, or which call for deliveries of less than minimum mill quantities.

March 9 . . . General Preference Order E-1-b amended providing a new method of scheduling deliveries of machine tools. Deliveries, effective May 1, are determined on the basis of backlogs, of urgency standing of each contractor, and of required delivery dates of orders for specified sizes and shapes.

March 16 . . . Closer control over the segregation of aluminum plant scrap was put into effect by Order M-1-d as amended. Amendment requires that persons generating 500 pounds or more of plant scrap in any one month must separate such scrap by form and alloy content.

March 22 . . . George H. Johnson, Director of the WPB Tools Division, urged shop education to prevent damage to cutting tools from misuse. He recommended that new workers be given instruction in changing tool bits before they get too dull; using guides to locate jig-holes; keeping spacing collars clean and parallel, and putting tools away carefully.

March 23 . . . Direction No. 1 under CMP Regulation No. 1 issued to protect consumers of steel whose orders have already been placed with mills from displacement of such orders in mill production schedules. Orders already promised by mills for shipment during the second quarter of 1943, shall not be displaced by any order received before April 15.

THE END.

FOR QUICK ACTION

● Our wartime strategy of making wheels only 3" in diameter and under is approved and endorsed by W P B. We make a 24-hour a day job of it. All vitally needed wheels are shipped promptly. There is no let-up. Our central location gives us a head start on deliveries.

AMERICA'S HEADQUARTERS FOR
MOUNTED WHEELS
SMALL GRINDING WHEELS

*Half a century of specialization has established our reputation as the Small Wheel People of the Country.

Custom Built Wheels, just the right wheels for your particular job, no matter how precise or difficult it is.

The moment we have your grinding problem, it's turned over to abrasive engineers who make up the wheels that do your job better and faster.

Years of research and Specialized* experience are behind each Chicago Grinding Wheel.

You can depend on prompt deliveries. GET IN TOUCH WITH US!

TEST WHEEL—Tell us the kind of job and size wheel you need. We'll be glad to send one without charge.

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe St. Dept TE Chicago, Ill.

TE-4

Send Catalog. Interested in

☐ Grinding Wheels ☐ Mounted Wheels ☐ Send Test Wheel. Size _____

NAME _____

ADDRESS _____

MORE GUNS!

KEEP YOUR SHOP HUMMING to keep the Axis running! Keep your critical tools on the job . . . . out of the scrap pile.

Worn and outmoded tools can be restored so they'll again produce MORE guns, tanks, ships, planes and all the other implements of war. Our more than 30 years' specialization in tool salvage has proved that we can recondition tools so that they will be the equal of new . . . . at a cost as much as 50 per cent less. Let a trial order convince you.

A COMPLETE RECONDITIONING SERVICE FOR TOOLS

EASTERN CUTTER SALVAGE CORPORATION, 30-32 LITTLETON AVE., NEWARK, N. J.
Western Plant · MASTER TOOL CO., INC., 5605 HERMAN AVE., N. W., CLEVELAND, OHIO
Chrome Plant · MASTER CHROME SERVICE, INC., 5709 HERMAN AVE., N. W., CLEVELAND, OHIO

NO PLACE FOR "Doubtful Screws"

. . . in the Machine Tools for Creating War-Vital Precision

Machine tools like the Robot Surface Grinders are important "weapons", not only on the production front, but on fighting fronts throughout the world. Repairing and rebuilding mechanized equipment requires shaping and sizing innumerable metal parts to accurate dimensions. For this vital job, performed under the worst possible conditions, only machines of lasting, dependable precision are suitable.

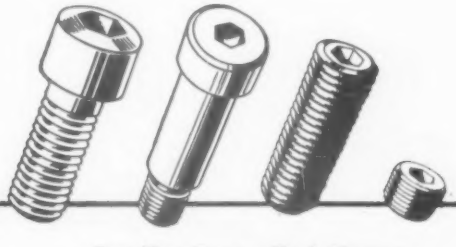
Because it might fail under stress, and delay the return of indispensable fighting equipment to battle, no "doubtful material" can be included in such machines. That is why Parker-Kalon Quality-Controlled Socket Screws are "on the preferred list" of so many machine tool manufacturers.

The unparalleled check-routine supervised by the Parker-Kalon Quality-Control laboratory eliminates "doubtful screws" . . . screws that *look* all right but fail to *work* right. You can be *sure* of the physical and mechanical characteristics of P-K Socket Screws . . . yet they cost no more! Parker-Kalon Corporation, 190-198 Varick Street, New York, N. Y.

Assembling the Robot Surface Grinder requires over 100 Socket Screws – about 60 to hold gears. The Robaczynski Machine Corp. of America, Brooklyn, N. Y., manufacturers of this equipment, get insurance against trouble by specifying "Parker-Kalon".

PARKER-KALON
Quality-Controlled
SOCKET SCREWS

Give the Green Light to War Assemblies

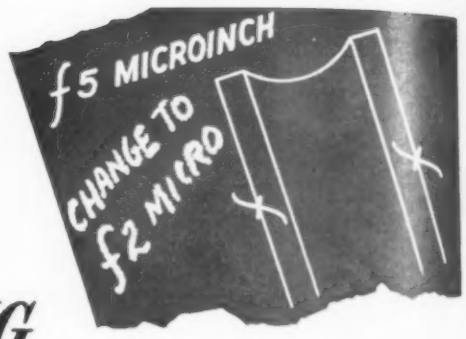


Quality-Controlled Means . . .

Complete test and inspection covering: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, Height and Concentricity; Socket shape, size, depth, and centricality; and Thread fit.

Well-known manufacturer producing ball bearing assemblies . . . Flat surfaces of inner and outer retaining rings to be furnished with a surface finish within 5 Microinches . . . Then—specifications suddenly changed to 2 Microinches, and without introducing new operations, the best surface finish that the company could grind was 3.5!

When our engineers arrived the company was lapping and polishing these surfaces—*and rapidly falling behind in production.*



NOW··they're GRINDING

these surfaces to .85 - 1.3 MICROINCH SURFACE FINISH, *using* CORTLAND CHUCKS AND SEGMENTS

Work called for grinding the flat surfaces on 5" O.D. ball bearing rings. Equipment consisted of Blanchard No. 18 Vertical Surface Grinder with rotary table. In our production tests we used 18" Cortland Segmental Chuck with four segments, as illustrated. These tests soon established the following record:

Rate of Feed	.016
Table R.P.M.	25.0
Total Feed	.002
Stock Removed	.001
Wheel Wear	.001
Dressings	none
Profilometer Reading	**.85 to 1.3 Microinch surface finish**

The company is now grinding all flat surfaces well within the required 2 Microinch surface finish, using their regular grinding machines equipped with Cortland Chucks and Segments, and is maintaining a high production schedule.

This is but one of a great many successful case histories proving that the principle of *Diagonal Shearing*, as embodied in the design of Cortland Segments and Chuck assemblies, is improving and speeding grinding output wherever a segmental chuck can be used. Write for Segmental Chuck Bulletin—free—and for information on grinding wheels of all types.

DIAGONAL SHEARING
Shock and resistance minimized as narrow end of segment starts grinding action. Large surface still exposed to coolant. Diagonal motion of straight inner edge of segment produces powerful shearing action. Increasing contact combines rapid stock removal with minimum heating.
Maximum area of segment in contact with work momentarily. As segment continues to pass across work, grinding area becomes smaller, with more surface exposed to coolant.

CORTLAND *Segmental Chucks*

CORTLAND GRINDING WHEELS CORP. • CHESTER, MASS.

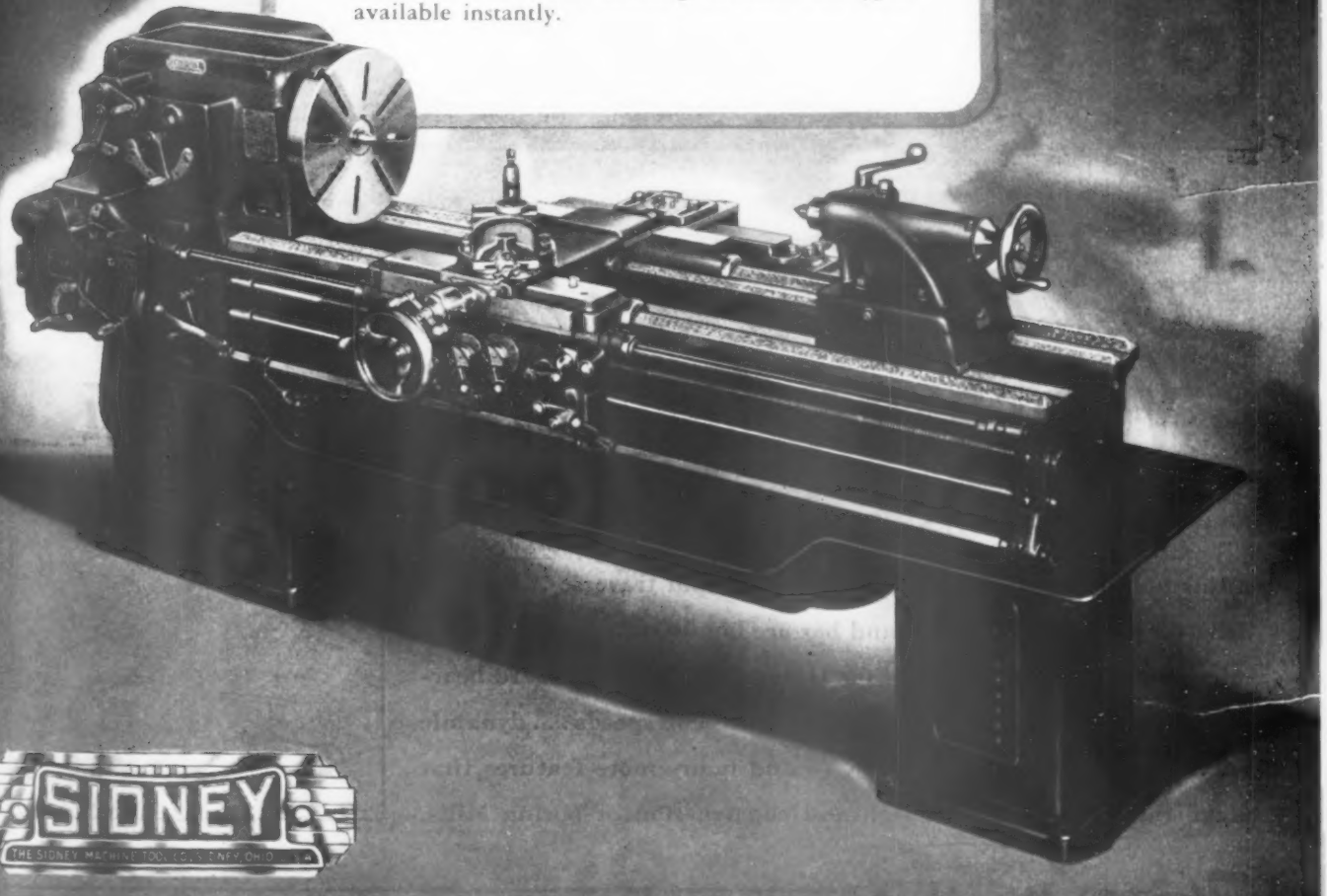
Brings Power-Speed-Accuracy to War Production Plants

SIDNEY LATHES

In hundreds of plants producing all manner of War material from guns to airplanes Sidney Lathes are faithfully producing a wide variety of parts, to close tolerances and maintaining rigid accuracy over long periods.

Ease of operation—sixteen speeds and forty-eight changes of threads and feeds provide maximum possibilities of all types of cutting tools. Smooth flow of power through continuous tooth herring-bone geared headstock—the additional center bearing for spindle and intermediate shaft assures the utmost in rigidity and accurate, smooth finished work.

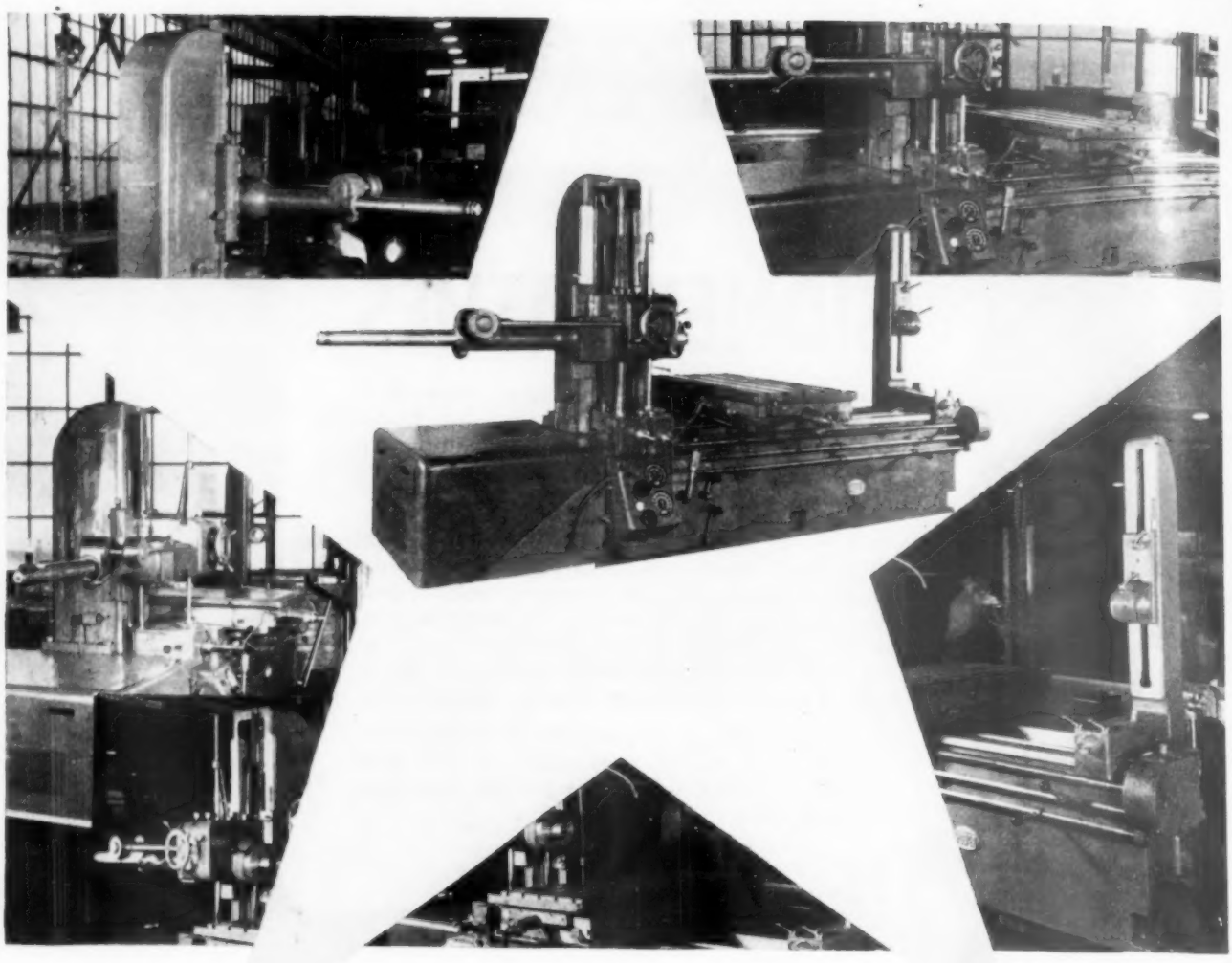
From the standpoint of continued precision, versatility and ultimate low costs make your next lathe SIDNEY. Bulletins covering all sizes and types available instantly.



The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

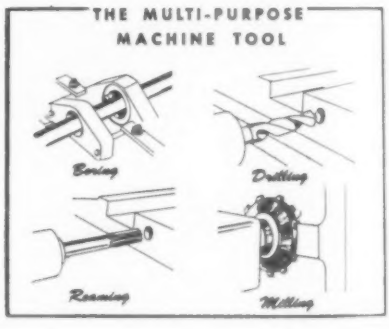
SIDNEY ESTABLISHED 1904 OHIO



Get the Latest Improvements IN THE YODER 3A HORIZONTAL BORING MILL

YOU'LL WANT THESE FEATURES . . .

Adjustable tapered gibs . . . a two-speed rapid traverse . . . direct drive for spindle . . . spindle and bar are lap fitted . . . verniers and micrometer dials are provided for vertical head and outboard bearing adjusting screws . . . infinite spindle feeds and speeds . . . dynamic braking . . . quick acceleration . . . and many more features that make this the latest in design and construction of boring Mills.



The YODER ENGINEERING MANUFACTURING **SALES COMPANY**

CLEVELAND, OHIO, U. S. A.

and Assures Proportionate INSPECTION USEFULNESS

The average wear-resistance of a Lincoln Park chrome plated gage is approximately five times that of a similar steel gage.

Today, thousands of worn gages and non-cutting precision tools are no longer discarded and replaced by new gages and tools in which critical metals are used, and for which many man and machine hours are required in manufacture. Instead they are salvaged by Lincoln Park processes in which they are carefully prepared for plating, are hard chrome plated, and then finished to specified tolerances. When completed, they are ready for a service life far exceeding their original period of service.

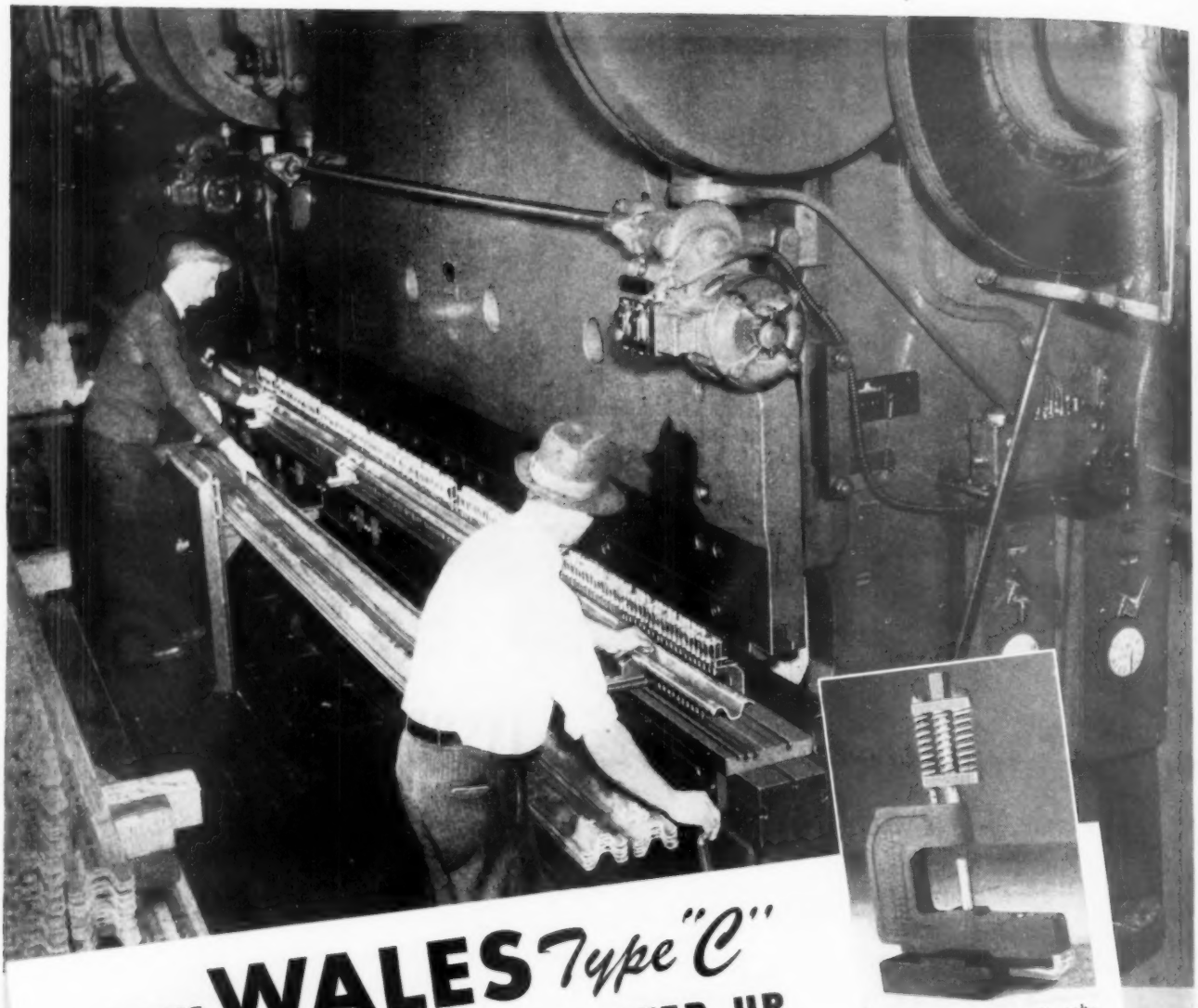
In addition, Lincoln Park chrome plated gages can be specified to much closer required limits than steel gages. Because allowances for wear can be reduced considerably, your production departments get the resulting benefits of greater manufacturing tolerances.

It's good business on your part . . . it's a definite contribution to the War Effort . . . to have Lincoln Park put new life and greater usefulness into all of your gages which can be salvaged by chrome-plating.

ARMY (E) NAVY

LINCOLN PARK TOOL and GAGE CO.

LINCOLN PARK, MICHIGAN



Wales Type C Hole Punching Units in operation in one of America's largest bomber plants.

HOW WALES *Type "C"* HOLE PUNCHING UNITS STEP UP BOMBER PRODUCTION

TIME AND MONEY-SAVING FEATURES OF WALES HOLE PUNCHING UNITS

Nothing is attached to press ram
Punch and die holder unit is self-contained
Punch and die are always in perfect alignment
Each individual unit can be removed or reset on rail
Punches, dies, guides, and strippers can be removed from holders quickly
Interchangeable punches and dies punch various sizes and shapes with the same holders
Die-setting time and press "down time" are cut from hours to minutes
Provide unlimited scattered and straight line set-ups

Changes in the location of rivet holes on stringer, angle or shaped members *no longer require non-productive hours of change-over time or days of wasted manpower caused by hand operations.*

These time-saving, manpower-saving advantages are made possible by Wales self-contained Punch and Die Units. To change a straight-line or staggered pattern is simply a matter of sliding each independent unit into relocated position on press brake rail. It's only a matter of minutes with a templet as a locating guide! No aligning of each punch and die is necessary because they are held in constant alignment by Wales Holder. Additional time is saved by using an extra group of Wales Units for set-ups on an extra rail off press. When the operating pattern in press has completed production run, the rails with Wales Units can be quickly removed and new pattern set-up of Wales Units on the extra rail can be moved onto press brake bed ready to operate. This arrangement keeps press brakes in practically continuous productive operation.

More planes of all types can be produced faster on your present brake facilities with Wales Hole Punching Units.

Remember, "There's Always Something New in the Wales Line" so keep posted by writing to—

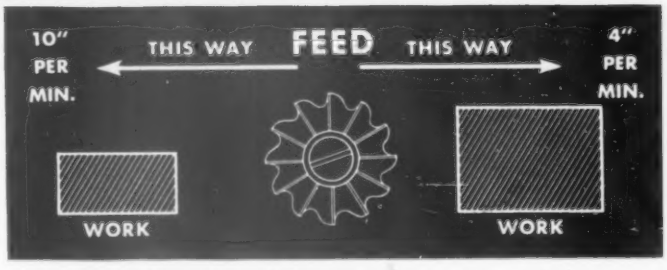
WALES - STRIPPIT CORPORATION
(FORMERLY THE STRIPPIT CORPORATION)
NORTH TONAWANDA, N. Y.
GEORGE F. WALES, President

Specialists in Punching and Notching Equipment

DO A "TWO-FISTED" MILLING JOB!

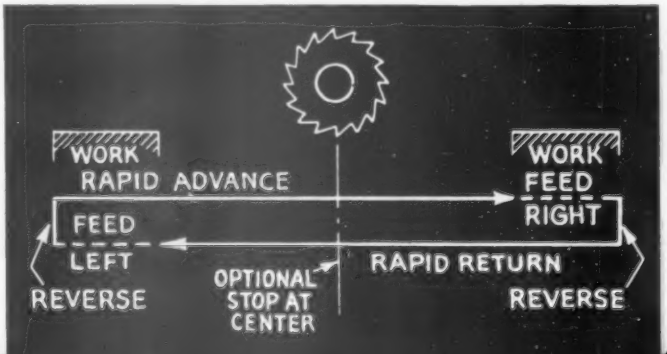
Here's how to *greatly increase production* on many jobs with a Kent-Owens No. 2-20 Milling Machine! You simply take advantage of the fact that this machine can do *one operation at one end of the table* and *another operation at the other end.*

The Kent-Owens is the only machine which has independent feed rate for both directions of table travel. This permits running one job at one end of the table and an *entirely different* job at the other end. Thus one machine does the work of *two!* Send for latest bulletins. Kent-Owens Machine Co., Toledo, Ohio.



This example shows feed to left set at 10" per minute and that to right at 4" per minute. Or both feed rates can be exactly the same.

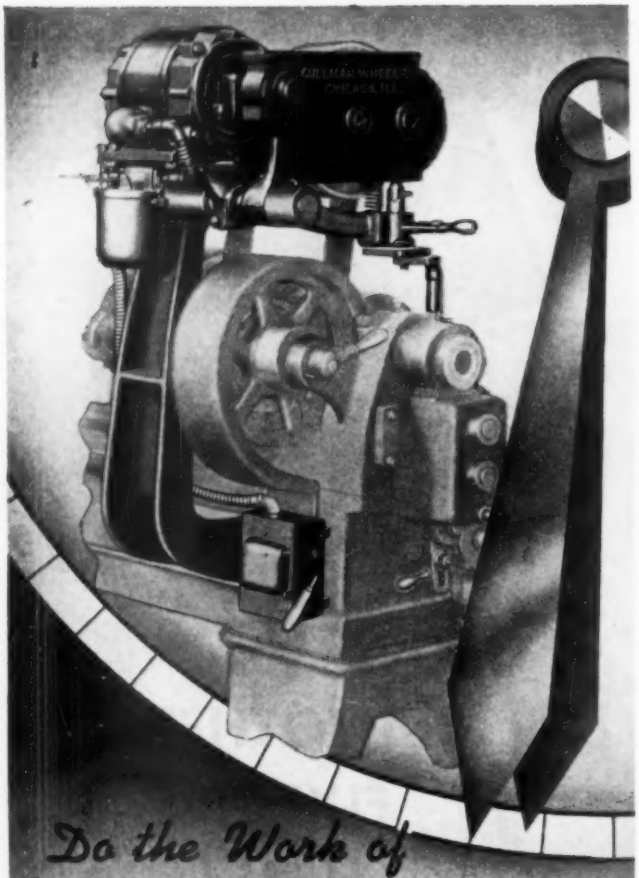
No. 2-20 Milling Machine has fully automatic cycle, and can be equipped with either one-way or two-way positive stop with dwell.



Call on

KENT-OWENS

for Milling Machines



Do the Work of
12 Hours in 9 with
CULLMAN DRIVES

With the ever-increasing demand for faster delivery it is vitally important to get maximum production from every machine and man-hour.

Cullman Drives will modernize shaft and belt driven lathes, screw machines, shapers, and similar equipment to give an increased output of more than 25%.

Cullman Drives give individual machine control, have greater flexibility, and are safer in operation than overhead line shaft drives. They permit the utmost in efficient arrangement for work flow and lighting.

Cullman Drives are sturdy and built for long life. They operate with belt-drive smoothness. They are easy to install and economical to buy. They are built for motors from ¼ to 15 H.P. Prompt delivery can be made on most sizes.

Write for full information on Cullman Drives and the 60 day trial plan.

CULLMAN WHEEL COMPANY
1352-R ALTGELD STREET CHICAGO, ILLINOIS

"Almost human"
that's what many users say about the

Ettco-Emrick
FOOT-OPERATED
TAPPING MACHINE

And they say that because this machine does fast, accurate tapping almost automatically. All it needs is someone to feed the work and step on the foot pedal.

The skill ordinarily required in tapping is supplied by the exclusive Ettco-Emrick Tapping Head with its high speed, hair-trigger sensitive central friction clutch and automatic reverse, and the sensitively counterbalanced foot pedal and drive mechanism.

That's why inexperienced operators — men or women — can maintain a production of ***2400 accurately tapped holes per hour*** with the standard 2-spindle Head — and up to 12,000 per hour with available Ettco-Emrick Multiple Spindle Tapping Heads.

GET FULL DETAILS IN THESE BULLETINS

BULLETIN No. 4 covers the Tapping Machine.

BULLETIN No. 3 covers the Multiple Tapping Heads.

Copies will be mailed to you on request. Write for them today.

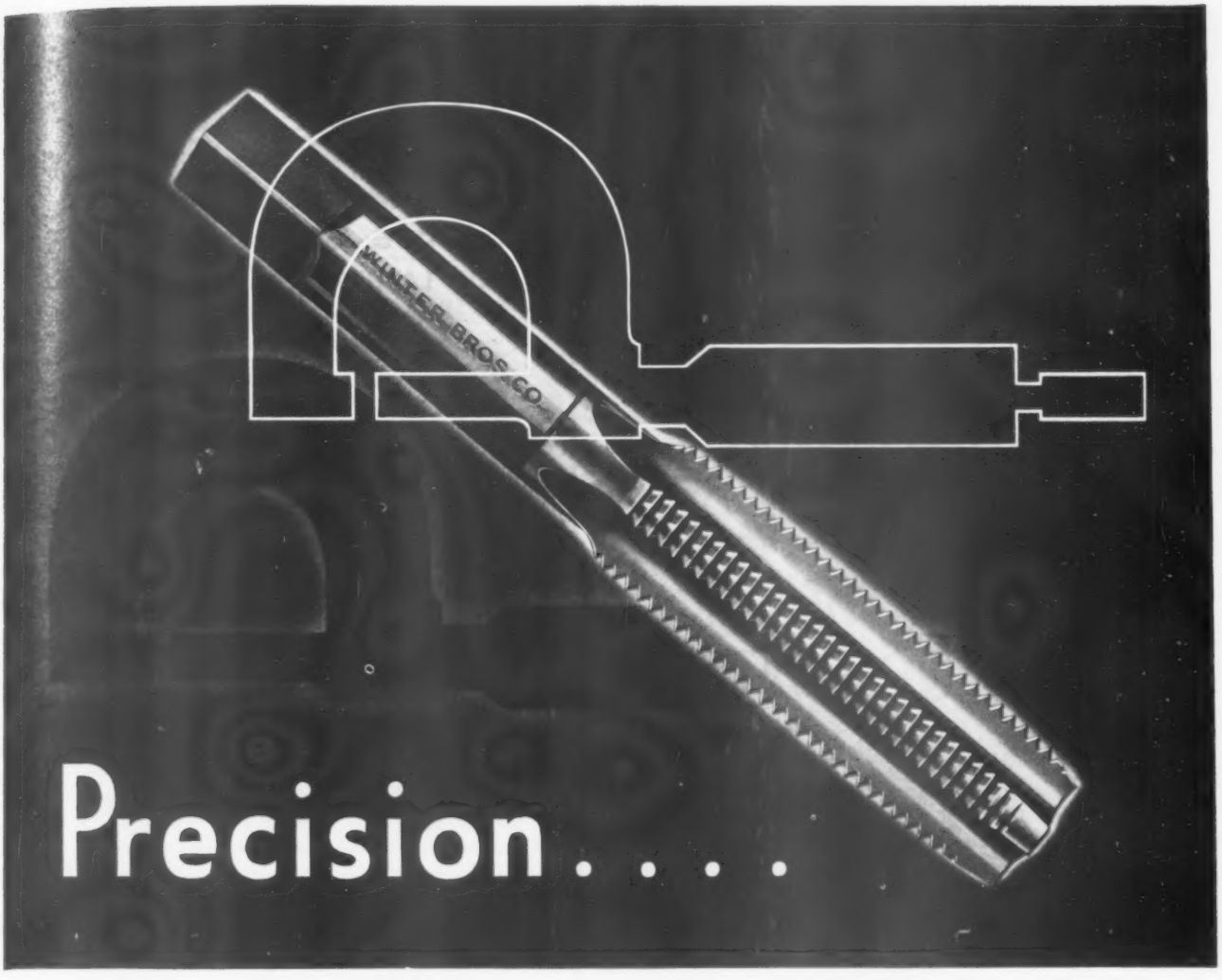
AT YOUR SERVICE— If you have a tapping problem or need higher tapping production the benefit of our 25 years of specialization in machine tapping is available to you. Write us.

ETTCO TOOL CO.

586 Johnson Ave., Brooklyn, N. Y.

Detroit • Chicago

The Famous Ettco-Emrick DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship



Precision. . . .

Winter taps are precision-made to produce accurately threaded parts for quick assembly — handle them with care! They will take plenty of punishment on the job; but no tap will stand being thrown down on a bench, or into a box with other tools, without chipping off teeth or dulling the cutting edges.

Use taps as you would a micrometer — with reasonably gentle care, that their usefulness be prolonged to the limit.

A DIVISION OF

THE NATIONAL TWIST DRILL & TOOL CO.

DETROIT, MICH.

Winter Brothers

COMPANY

Wrentham, Massachusetts, U. S. A.

MANPOWER *plus* RADIAL DRIVE COUNTERBORES *and* COUNTERSINKS *are helping to* WIN THE PRODUCTION BATTLE

Proudly ECLIPSE RADIAL DRIVE Counterbores and Countersinks have participated in the "battle of production."

Because of their sturdy construction, positive and accurate alignment, simplicity of design, quick interchangeability, plus ability to withstand greater overloading than most inter-locking drives, the ECLIPSE RADIAL DRIVE principle has proven its worth by consistently cutting down production time and decreasing tool breakage.

ECLIPSE COUNTERBORE COMPANY

DETROIT ● MICHIGAN

INSERTED BIT — OK — METAL CUTTING

TOOL SYSTEM

Single Point Tools

FOR LATHES PLANERS SHAPERS, Etc.

These tools embody various locking designs. In some, the bits are held in mated serrations; in others, round-shank bits are locked in a drop seat. In others, the locks are different still. The bodies, or holders, are made of drop-forged alloy steel and the bits may be had in high speed steel or tungsten carbide tipped.

MILLING CUTTERS

BORING HEADS COUNTERBORES FACE MILLS END MILLS REAMERS

As in the Single Point Tools, the blades of O K Milling Cutters are separate cutting units, the bodies are drop-forged alloy steel. The blades are driven into serrated mating slots. There they lock automatically and positively without pins, wedges or set-screws; yet they are instantly adjustable in line of wear. All O K Tools SAVE HIGH SPEED STEEL!

There's an O K Tool for every metal-cutting need, with a wide assortment of bits and blades. Today the O K System is doing an outstanding job in the production of precision war products. Tomorrow it will resume its important place on the peace time production lines of the country. Look into it now — with "tomorrow" in mind!

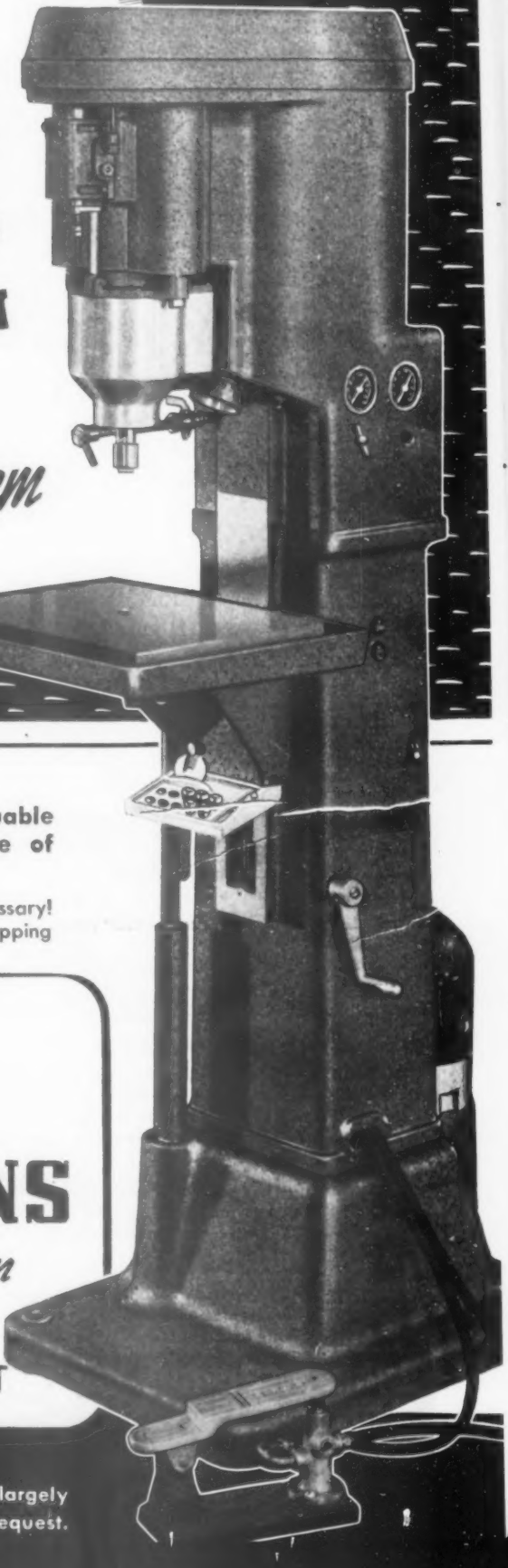
THE OK TOOL CO., SHELTON, CONN.
Originators of the Inserted-Blade Principle

HAVING TOLERANCE PROBLEMS ON TAPPING OPERATIONS?

2 FEATURES

Insure Continuous, Trouble-Free TAPPING PRODUCTION

...and only Haskins has them



WITH HASKINS TAPPERS ON THE JOB there's no loss of valuable production time, no wasting of vital war materials, because of failure to maintain tolerance requirements.

Air Operation uniformly controls the accuracy of the work. To Class 4 fit when necessary! Each part is precision tapped *exactly* like every other, every hour of the day. Tapping pressure is always precisely the same. Thus tap life is longer—much longer. And tap breakage is almost completely eliminated.

Piece Part Control, applicable on many jobs, makes tapping practically automatic. Placing the part in the fixture actuates a micro switch and—*air does the rest*—starting and completing the tapping operation. The operator's two hands are free to feed parts faster than by any other method.

That's why tapping the **Haskins** way is definitely more accurate, definitely less costly. H. G. Haskins Company 2756 W. Flournoy Street, Chicago.

AIR Control

HASKINS

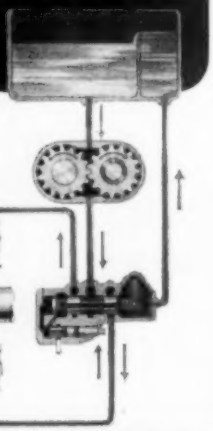
Precision

TAPPING EQUIPMENT

HASKINS

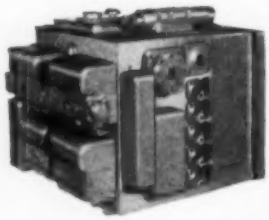
FOR ADDITIONAL TAPPING TIPS send for our latest literature, devoted largely to war work. Gives many money-saving, money-making ideas. Free on request.

GET YOUR HYDRAULIC CIRCUITS THIS WAY!



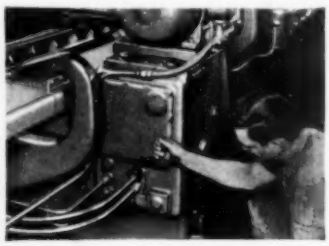
Typical Barnes simple circuit. Circuits are designed for your machine and shipped in compact units for ease of installation.

SIMPLIFY ASSEMBLY ... SPEED DELIVERY



• Complete hydraulic circuits, for smoother machine performance are easy to get. There is no need for securing pumps, valves, cylinders etc. from various sources of manufacture. Any combination of feed, traverse, clamping, indexing etc. that you need comes to you in a compact unit ready to install. All are standard proven elements, used in various combinations to suit the functions of your machine. This means quicker deliveries to your customers.

EASY TO INSTALL



If you are now using mechanical feed transmissions on your machines or, if you are buying hydraulic elements (pumps, valves, etc.) from different sources you will benefit materially by designing your machines for Barnes Hydraulics.

TWO METHODS AVAILABLE

METHOD 1 — Barnes Self-contained Hydraulic Unit can be designed with necessary pumps and valves for all hydraulic functions of your machine. Oil reservoir is included—providing cylinder space and connecting two pipes to each cylinder constitutes your total hydraulic effort.

METHOD 2 — Use Barnes Panel Unit — similar to above except provision must be made in machine for oil reservoir and motor mounting.

BARNES hydraulics

FREE DATA

40 page booklet contains detail descriptions of all Barnes elements and typical installation circuits. Write for copy today. Ask for Bulletin T. E. 443.

John S. Barnes Corporation

DETROIT SALES OFFICE
503 NEW CENTER BLDG.
TR-1-1706

MAIN OFFICE AND FACTORY
ROCKFORD, ILL.

Hammond

CARBIDE TOOL GRINDERS

NEW 6" BELTED MODEL

ANY ELECTRICAL SPECIFICATIONS AVAILABLE

MODEL 6-B

For fast and accurate silicon carbide or diamond wheel grinding the new Hammond Model 6-B Carbide Tool Grinder is multi V-belt driven. V-belt drive plus precision spindle dampens motor vibration and provides true, smooth running wheels. Wheels wear longer and grind faster because the Hammond 6-B gives you velvet-smooth operation. WRITE FOR BULLETIN NO. 202.

Hammond Carbide, Tool and Snagging Grinders, Abrasive Belt Surfacers Automatic and OD Cylindrical Finishing Machines, Polishing Lathes

Hammond Machinery Builders INC.

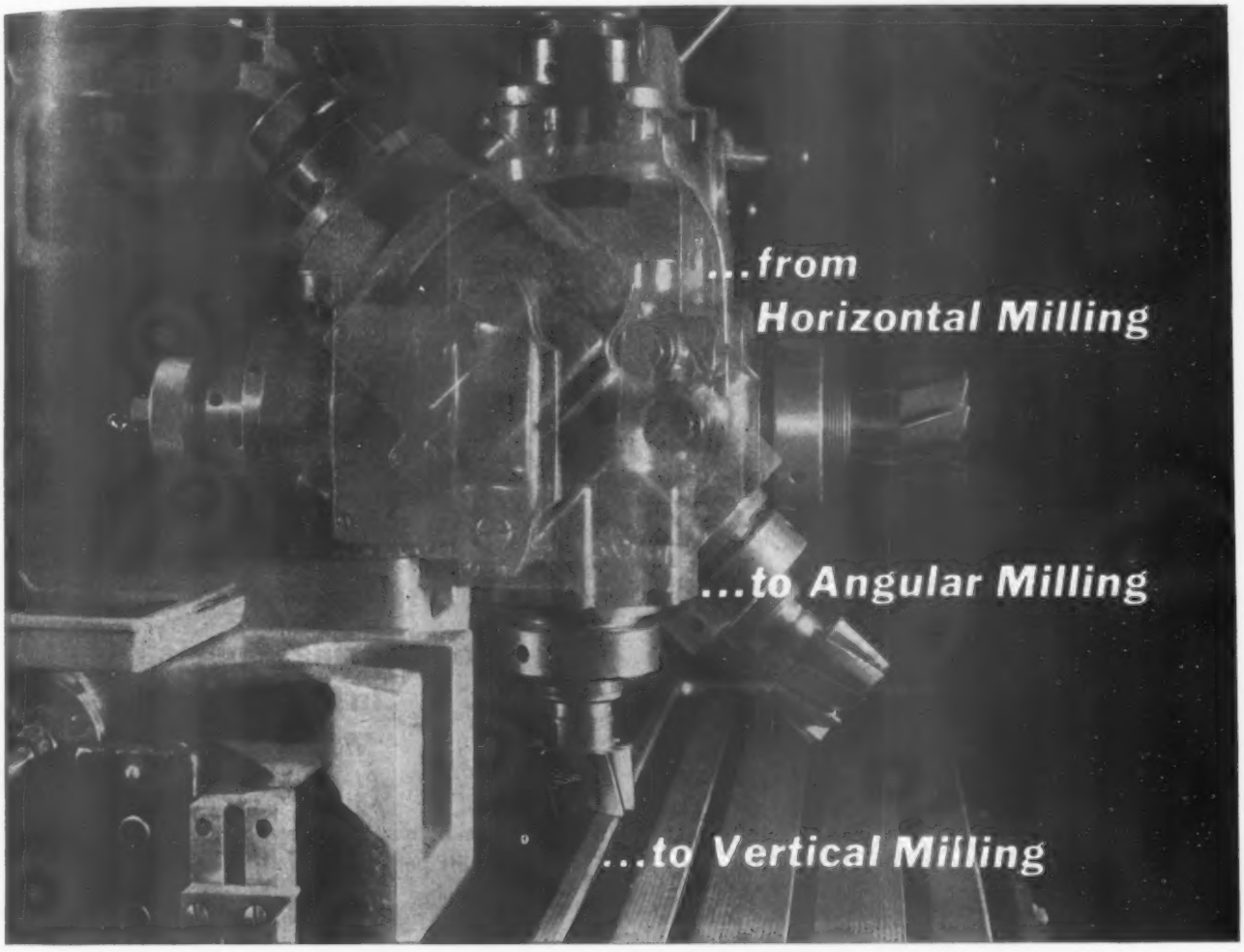
KALAMAZOO, MICHIGAN

1636 DOUGLAS AVENUE

Eastern Branch — 71 West 23rd St., New York, N. Y.

Quick Changes on Van Norman

RAM-TYPE MILLING MACHINES

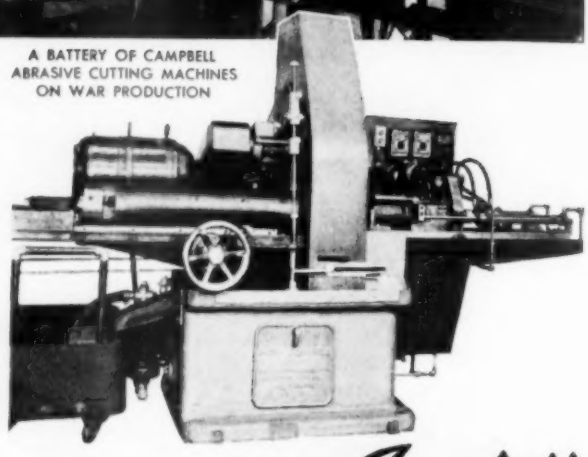


When the operator has completed a horizontal cut on a Van Norman Ram-Type Miller, and wishes to proceed to an angular or vertical cut . . . *he does not need to touch the set-up on the table.* All he has to do is unclamp the swiveling cutterhead, swing it to the required position, reclamp . . . *and start the next cut.* Only a matter of moments, compared with the time needed to reset the work. And one of the greatest sources of errors is completely avoided. This exceptional ease and convenience of operation provide gains in time, accuracy and output. So today, throughout America's war industries, Van Norman Ram-Type Millers are delivering the goods in great plenty . . . and in plenty of time.

VAN NORMAN
Machine Tool Company
SPRINGFIELD, MASSACHUSETTS

In June, 1942, Van Norman was awarded the Army and Navy E in recognition of its war production record

A BATTERY OF CAMPBELL ABRASIVE CUTTING MACHINES ON WAR PRODUCTION



YOU, TOO, CAN GET *Campbell* ABRASIVE CUTTING MACHINES TO MEET YOUR SCHEDULES

● Production in the plant pictured above required several different **CAMPBELL** models. Your plant may need only one. The certain way to find out—and get new cost facts on cut-off operations—is to write the Campbell Engineering Department.

State the materials you are cutting—shapes, sizes, lengths before cutting, lengths of cut-off pieces and production required per hours. From this data we will develop production procedures and costs for you.

Remember, **CAMPBELL** has a complete range—the *only* complete range—of **ABRASIVE CUTTING MACHINES** as the foundation for these recommendations, 8 types, 19 models. And they currently are being used on all grades of steel, annealed and unannealed, non-ferrous alloys—solid bar, tubular and flat—and on plastics, glass and ceramics.

Send your data to the Campbell Engineering Department now—no obligation.

Campbell

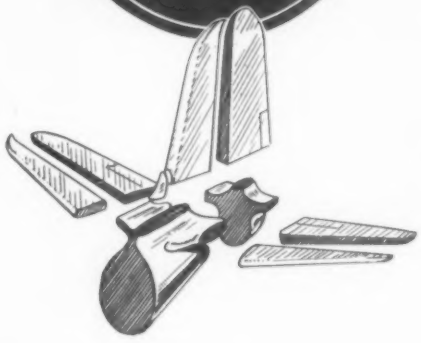
ABRASIVE CUTTING MACHINES

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT

ACCO
AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

HAVE YOU A *Gluing Problem* IN FABRICATING *Aircraft Parts?*



Engineering Specialists In Bonded Materials

●

The use of bonded materials in the fabrication of aircraft parts has given rise to many complicated gluing problems. As consultants in this specialized field, we are in a position to counsel with you on technical problems of this nature and recommend practical methods of solving your difficulties.

Also Designers of Jigs, Tools, Fixtures, Gages, Dies, and Special Machines

WRITE US!

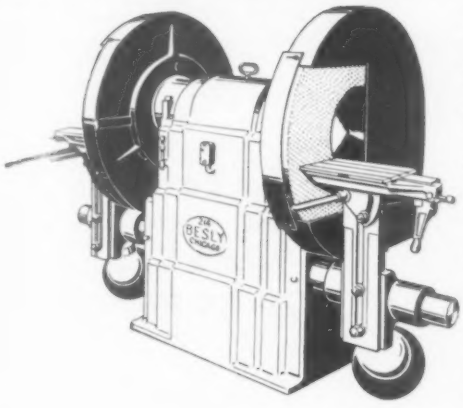
Outline briefly the nature of your production problem and you will hear from us promptly.

ADECO

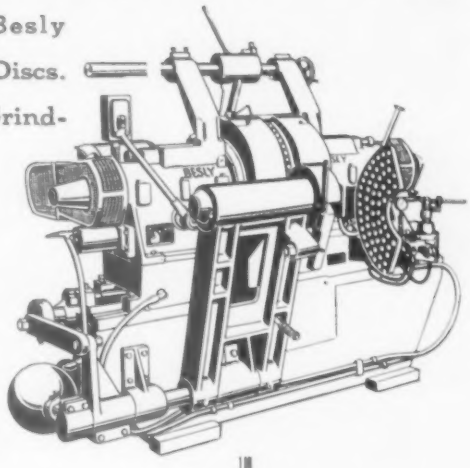
American
Designing & Engineering Co.

1209 WASHINGTON BOULEVARD DETROIT, MICHIGAN

DISC GRINDERS BECOME REAL PRODUCTION TOOLS



when equipped with Besly Titan Steelbac Abrasive Discs. This modern Bolted-On Grinding Member with 1″, 2″, or 3″ useable Abrasive is fast, cool cutting, safe, economical and easy to mount. In Stud Type and Nut Inserted. Always made of Resinoid Bond.



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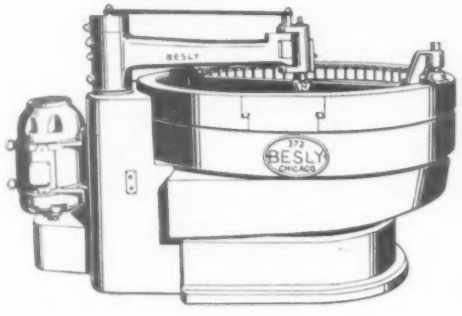
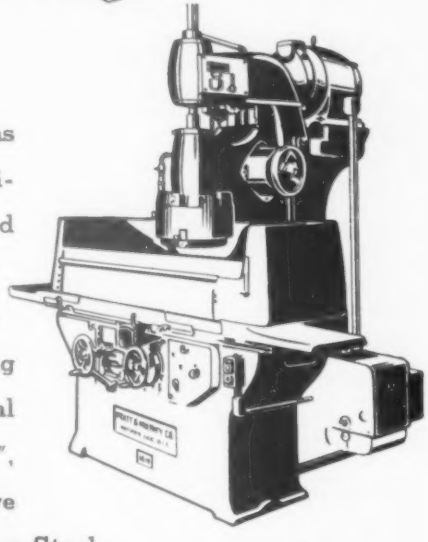


The Besly Titan Steelbac has been adopted by many prominent users of Blanchard and Pratt & Whitney Type Grinders. The Besly Titan Steelbac has eliminated the sulphuring operation and waste incidental to such procedure. You get 3″, 4″ or 5″ of useable Abrasive when you specify Besly Titan Steelbacs for your Blanchard or Pratt & Whitney Type Grinder.



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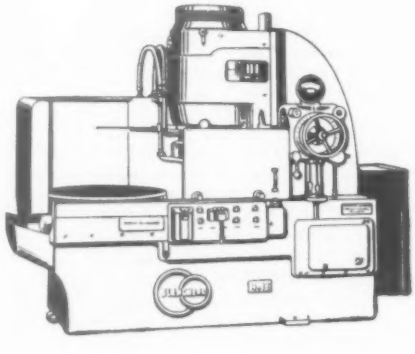
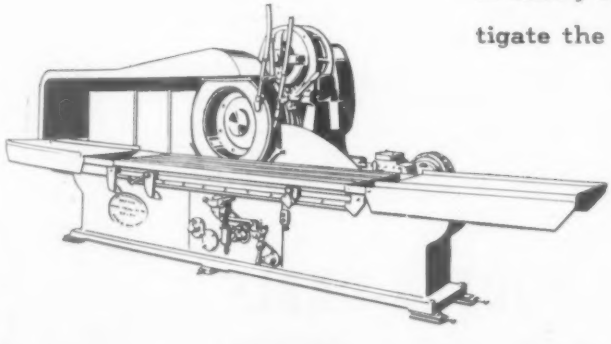


If you operate a Travelling Table Grinder of the Bridgeport, Diamond or Safety Type it will pay you to investigate the advantages of Besly Titan Steelbacs on that machine. Used in connection with such Grinders, they eliminate heavy Ring Wheel Chucks and wasteful stubs. Besly Titan Steelbac Abrasive Discs are furnished in various grains and grades, also proper density depending on the particular application.

Write for your copy of Booklet on Besly Titan Steelbacs



CHARLES H. BESLY & COMPANY

118-124 NORTH CLINTON STREET ★ CHICAGO, ILLINOIS

Time Saving Products from this Book of

WAR PRODUCTION BOOSTERS

Send for Your Copy FREE

Illustrates and describes in detail IDEAL Live Centers, Demagnetizers, Marking tools, Balancing Ways and other Machine Tool Accessories that speed Production and keep costs down.

IDEAL LIVE CENTERS

Work with Heavier Loads at Higher Speeds

On lathes, Screw Machines, Grinders, Millers, etc.

Save Man hours on centering work. Save cost of fast wearing dead centers. IDEAL Live Centers rotate with the work. Equipped with highest precision radial ball bearings and tapered roller bearings.

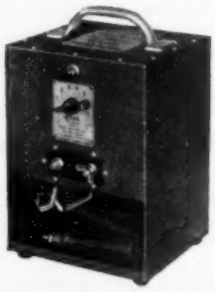
TRIPLE DUTY

Reduce set up time . . . Three interchangeable center pieces meet the requirements of all centered and uncentered work. An exclusive IDEAL feature.

IDEAL METAL ETCHER

Permanently Marks Smooth Surfaced Tools, Dies, Parts, Gages, etc.

NEW!



Prevents costly delays caused by loss, theft and mistakes.

New fourteen-heat Metal Etcher burns identifying marks right into smooth surfaced iron, steel, and their alloys, regardless of the hardness of the metal . . . Convenient ground clamp for etching large, heavy parts and castings.

Write for your Machine Tool Accessories Catalog, Today

IDEAL COMMUTATOR DRESSER CO.

4152 Park Avenue — **Sycamore, Illinois**

Sales Offices in All Principal Cities

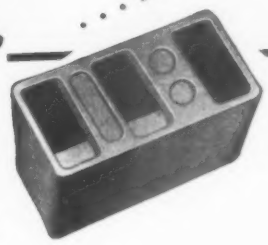
In Canada: Irving Smith, Ltd., Montreal, Quebec

Why Waste *Surfacing* Time?

This new

PORTER-CABLE G-8 SURFACER

does it in 1/10TH THE TIME . . . Freehand!



● This manganese box—3" x 8", with a 3/16" wall, had to be machined absolutely flat top and bottom to close limits. Milling could only hold it to +.002, —.003 variation from the true flat. Freehand surfacing on the G-8 Porter-Cable machine holds it to +.001, —.001 variation! — and *nine boxes to one are now being turned out.*

★ ★ ★

Versatile Porter-Cable Wet-Dry Belt Surfacers can do many a job faster and better than ordinary millers, shapers and grinders. Examples in actual production show speed-ups ranging from *5 to 50 times faster!* As to precision, tolerances of .0005 are held with the aid of simple fixtures.

Wet-Dry Belt Surfacing works equally well with hard or soft metal, plastics, glass, fibre and compositions. High-Speed abrasive belt produces even, true, fine-finished surfaces, either flat or curved. Used *wet*, it eliminates heating, warping, discoloring and dust . . . safely handles inflammables.

Shift to the Porter-Cable Wet-Belt Surfacing! Send now for our free new booklet—it will show you startling new applications you can use in your war-production!

UNSKILLED WORKERS FIND BELT SURFACING EASY AND SAFE!

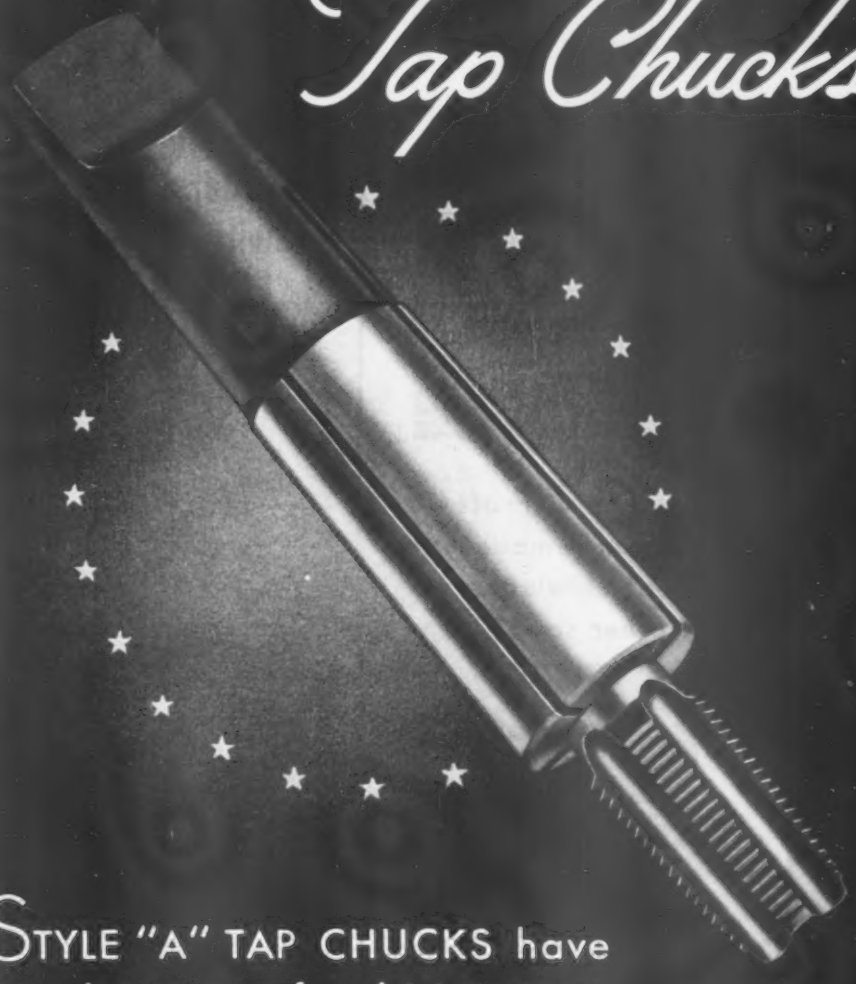
Porter-Cable Model G-4 releases your skilled men for more intricate jobs . . . gets high production from women and untrained personnel. Simplicity and adaptability make it perfect for second operations.

PORTER-CABLE MACHINE COMPANY

1610-4 N. SALINA ST.

SYRACUSE, N. Y.

Scully-Jones Tap Chucks



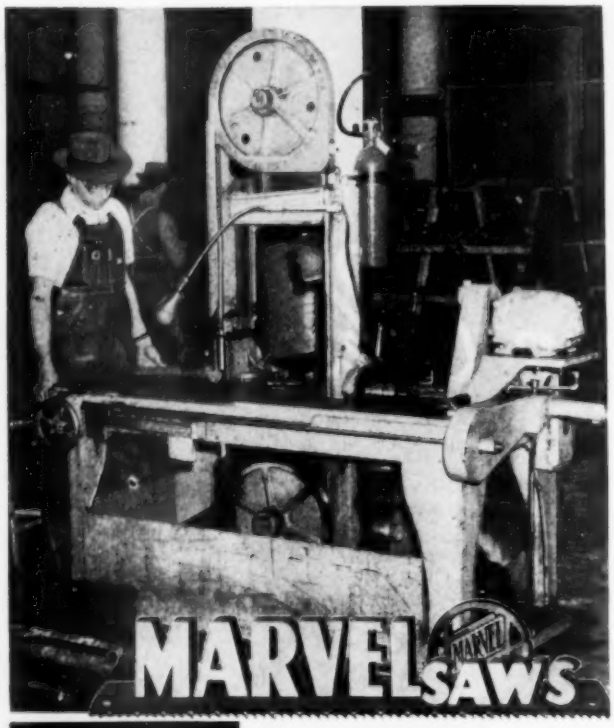
STYLE "A" TAP CHUCKS have five big advantages for driving taps:

1. Drive by the square—giving a positive drive.
2. Centers by the shank—for correct alignment.
3. Spring collet action—for locking tap in chuck.
4. Four point bearing—giving collet action.
5. A tapered shank—fits any MORSE TAPER HOLE.

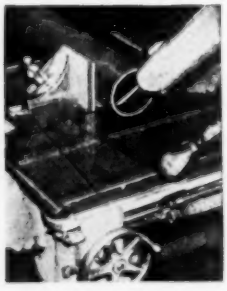
RECOMMENDED FOR MAXIMUM RIGIDITY AND CONCENTRICITY IN TAPPING OPERATIONS

SCULLY-JONES AND COMPANY

1901 SO. ROCKWELL STREET • CHICAGO, ILLINOIS. U.S.A.



at *Vultee Aircraft* — "cuts can be made that are not obtainable on any other saw!"



At Vultee Aircraft Inc., this MARVEL No. 8 "has a very wide use" and "has proved a very efficient machine," for it is in continuous use sawing Pipe — all diameters; Bar stock — both machine stock and tool steel Structural steel — angles and shapes and Steel Plate. What other saw could make the angle cut illustrated in the close-up but the universal MARVEL No. 8 Metal-cutting Band Saw on which the blade feeds into the work at any angle from 45° right to 45° left!

Buy from your local distributor

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave.
Chicago, U. S. A.

Eastern Sales Office:
225 Lafayette St., New York

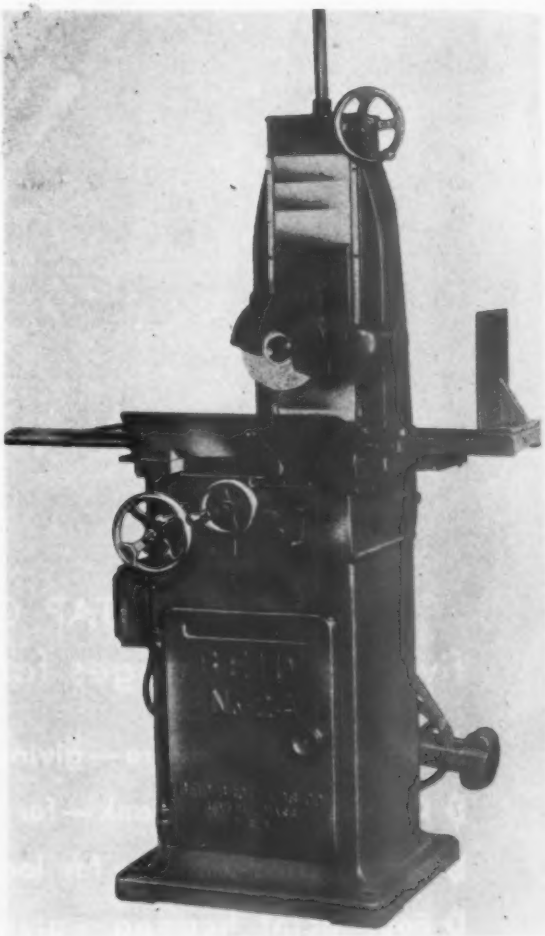
REID BROS. CO.

INCORPORATED

Thanks the many thousands that visited our booth at the A. S T. E. show.

★ ★ ★

Customers that placed orders at the show will receive EXCELLENT Deliveries.



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H. LEACH MACHINERY CO.

387 CHARLES STREET PROVIDENCE, RHODE ISLAND

134 DISTRIBUTORS

IN U. S. and CANADA

PROPERLY DESIGNED DROP FORGINGS

Airplane propeller hub being forged on Chambersburg Steam Drop Hammer

THE solution of the increased load thrown on the forging industry lies not only in the use of modern equipment . . . such as Chambersburg Hammers . . . but also in properly designed forgings . . . which mean less metal . . . and less machining. Less metal for each forging, less machining necessary to finish, fewer man-hours per piece and less horsepower mean savings of vital importance NOW.

CHAMBERSBURG ENGINEERING CO • CHAMBERSBURG, PA.

THE CECOSTAMP • A NEW METHOD OF PRODUCING AIRPLANE STAMPINGS

A new, high-production, easily controlled, impact-type drop stamp, designed by Chambersburg engineers after a close study of aircraft manufacturing requirements. In the rapid production of drop stampings from stainless steel, high strength aluminum alloys and other metals of low ductility, the CECOSTAMP has taken its place with the newest tools and techniques made necessary by this great industry.

CHAMBERSBURG

HAMMERS • CECOSTAMPS • PRESSES

Since 1940, when the advertisement shown at the left was first run, Chambersburg Engineering Company has been urging the careful design of drop forgings to eliminate excess scrap, excess machining, excess man hours. The Buick advertisement shown below is an excellent example of careful design—plus Chambersburg Hammers.

A Case of LESS SCRAP, MORE FIGHT

Two sleek and polished examples of superfine machining in a propeller shaft for a Buick-built Pratt & Whitney aircraft engine.

It used to be cut by slow and painful whittling from a forging made from a 184-pound bar of steel.

By changing the forging method, Buick found a way to get the same results from a steel bar weighing only 165 pounds.

Nineteen pounds less material to be cut away, 19 pounds less scrap to be sent back for remelting, considerably less expenditure of precious machine tools and—*!!! propeller shafts from the same material that used to deliver only 100—in less time per shaft!*

The country needs scrap metal—all you can dig up.

It also needs to avoid waste of materials in the making of fighting tools.

So we'll strike a bargain with you.

Do your share in "getting in the scrap"—and we'll do ours, in this and other instances like it, to get the utmost "fight" out of the materials we work with.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

BETTER AUTOMOBILES ARE BUILT BUICK WILL BUILD THEM

BUICK DIVISION OF GENERAL MOTORS

CHAMBERSBURG

HAMMERS • CECOSTAMPS • PRESSES

Chambersburg Engineering Co. Chambersburg, Pa.

CHECK SPINDLE ALIGNMENT CAREFULLY

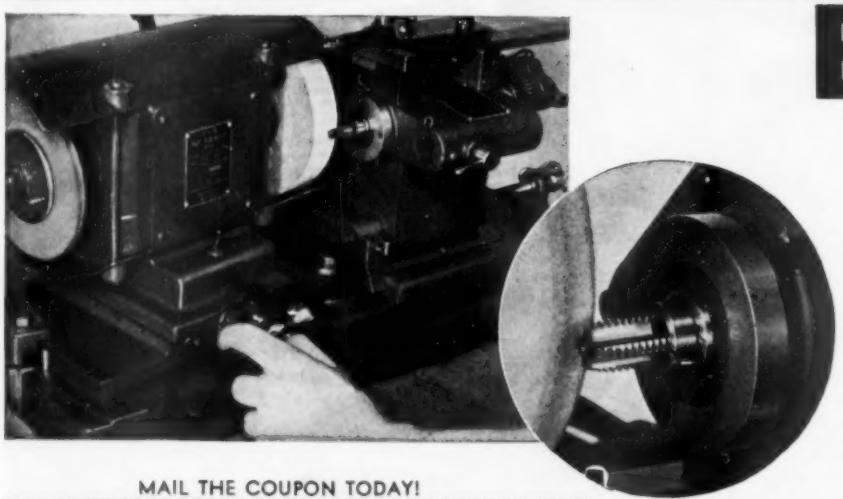
The best reamer cannot produce a straight accurate hole if the machine spindle is worn and out of alignment. For the best results from your reamers check spindle alignment frequently.

A Putnam Spiral Fluted Chucking Reamer

is the tool for any reaming job that requires maximum cutting speed combined with greatest accuracy.

And because of the spiral—an exclusive Putnam design—chips do not jam and scratch the finish even when reaming the deepest holes.

PUTNAM TOOL COMPANY
2985 Charlevoix Avenue • Detroit, Michigan



BLAKE

Tap Grinders for Accurate, low cost tap sharpening

Don't discard dull taps—sharpen them on the chamfer on a Blake Tap Grinder. This versatile machine helps you five ways, (1) it conserves High Speed and Carbon Steels, (2) it increases tap life by thousands of holes, (3) it eliminates delays caused by waiting for new taps, (4) it maintains the accuracy of your products, (5) it is also ideal for grinding countersinks and other small tools.

The Blake Tap Grinder will sharpen right- or left-hand taps with 2, 3, 4, 5, 6, 8 or ten flutes. Capacity is from No. 0 to 2 inches.

Get complete information on the Blake method by mailing the coupon today!

MAIL THE COUPON TODAY!

Please send folder giving complete details on the Blake Tap Grinder.

NAME..... TITLE.....

COMPANY.....

STREET.....

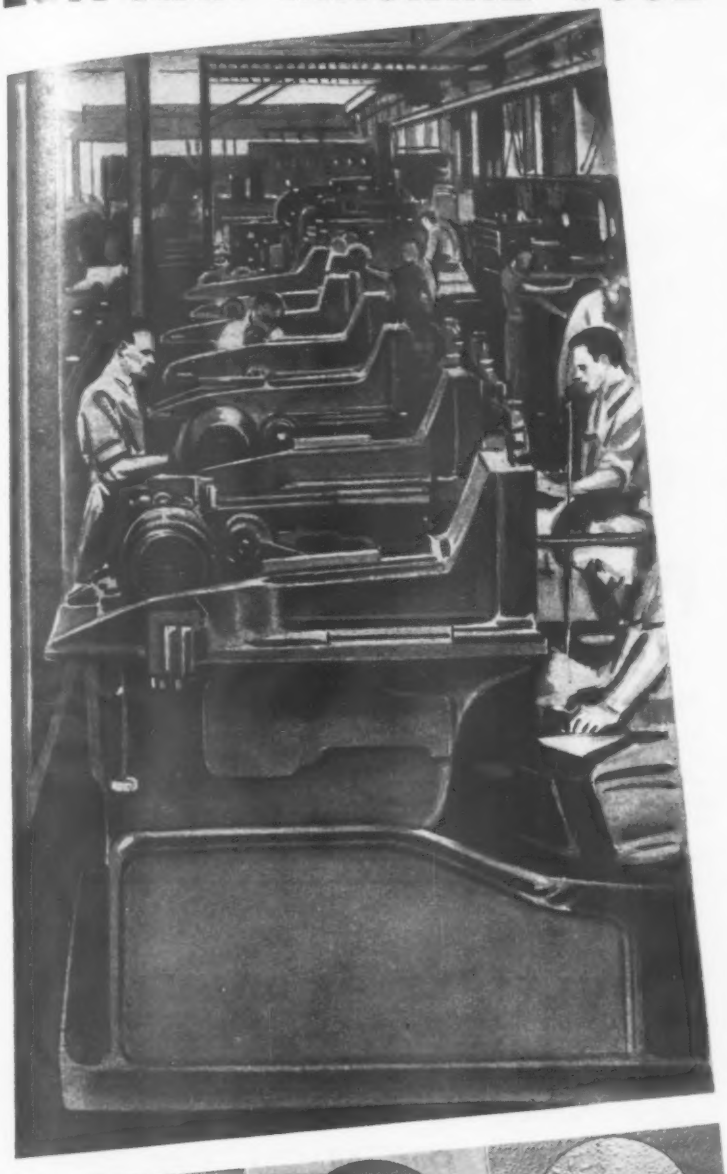
CITY..... STATE.....

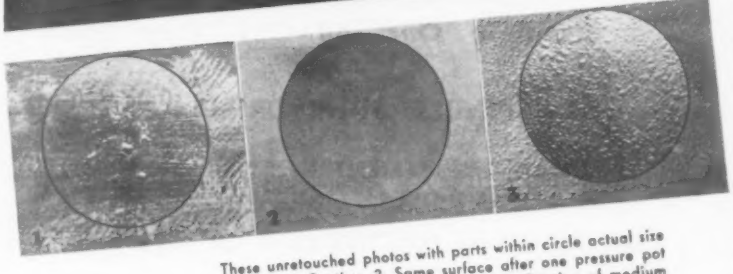
T.E.

EDWARD BLAKE COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES

EGYPTIAN MACHINE TOOL FINISHING SYSTEM





These unretouched photos with parts within circle actual size show 1. Bare Casting. 2. Same surface after one pressure pot spray coat has been applied. 3. After application of medium stipple second coat over first coat. Left half shows surface after a coat of Machine Tool Enamel has been applied over the two previous coats.

GIVES QUALITY MACHINES A QUALITY FINISH

It takes ten months to build a gear grinder as shown here. This and other production line tools... automatic screw machines, gang drillers, turret lathes and production milling machines . . . each is designed to do a specific job. EGYPTIAN's new machine tool finishing system is also made for a single specific purpose—to give *machine tools* a peace time appearance and protection with war time speed and economy.

Application is simplicity itself:

1. Bare casting is covered with one pressure pot spray coat. No primer required.
2. A medium stipple second coat is applied, giving uniform appearance and camouflaging all rough spots in casting.
3. A final coat of EGYPTIAN Machine Tool Enamel completes the job.

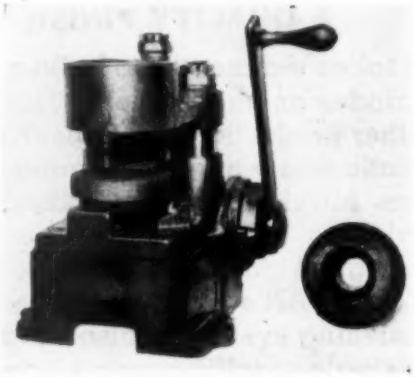
All coats air-dry quickly, are oil and alkali resistant, may be applied with gun or brush, and a smooth finish may be obtained if desired.

Specify EGYPTIAN for finishing all your production line and machine-shop tools.

Send for trial order at drum price and ask for a copy of our 1943 edition of "U. S. Gov't Specification Finishes." Just ask for "Spec" Book T E.

THE EGYPTIAN LACQUER MANUFACTURING CO.
ROCKEFELLER CENTER—NEW YORK, N. Y.

EGYPTIAN
***Superior* FINISHES**



FEATURING

SWARTZ LS TYPE JIGS

Round parts are held firmly in this type fixture because drill pressure is used to help hold the work against torque. The lower adapter grips and centralizes the part, while the top plate squares and clamps. As drill pressure forces the part lower into the gripper, the top plate automatically lowers so that the work does not become loose.

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley **ASK FOR CATALOG 941** **Detroit, Michigan**

Represented by

Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Houston—Engineering Sales Co.

Chicago—Ernie Johnson
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
St. Louis—Mill Supply & Mach. Co.
Beverly Hills, Cal.—Criterion Tool Sales
Oneida, N. Y.—W. F. Himmelsbach

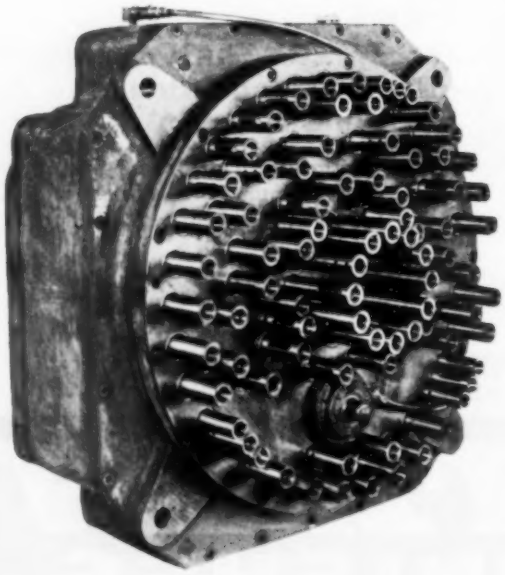
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

NIGHT and DAY

Buhr

MULTIPLE PRODUCTION DRILL HEADS

Are Putting Holes in Parts Used in Our All-Out War Effort



84-SPINDLE BUHR DRILL HEAD

VERTICAL ADJUSTMENT IN SPINDLES TO LENGTHEN DRILLS.

OIL PUMP FOR POSITIVE LUBRICATION.

MOUNTED ON A VERTICAL HYDRAULIC DRILL PRESS.

FOR DRILLING ALL HOLES IN SUPER CHARGER COVER.

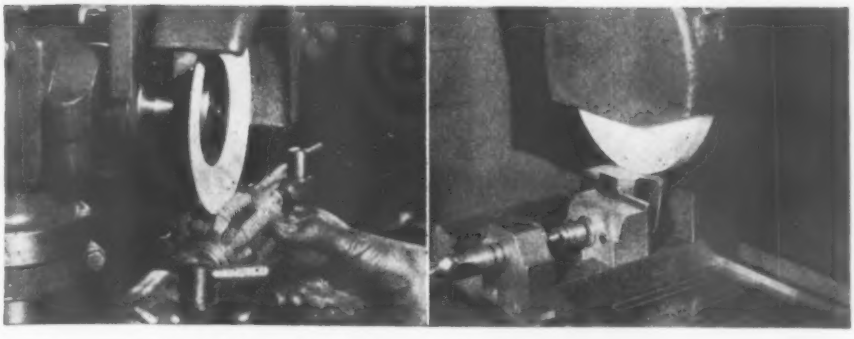
BUHR MACHINE TOOL CO.

ANN ARBOR **MICHIGAN**

Specialists in Multiple Spindle Drilling, Boring, Reaming, and Tapping Equipment

. . LOOK at the Large Pores!

And here are two jobs on which this Norton Open Structure Grinding Wheel can Boost Production

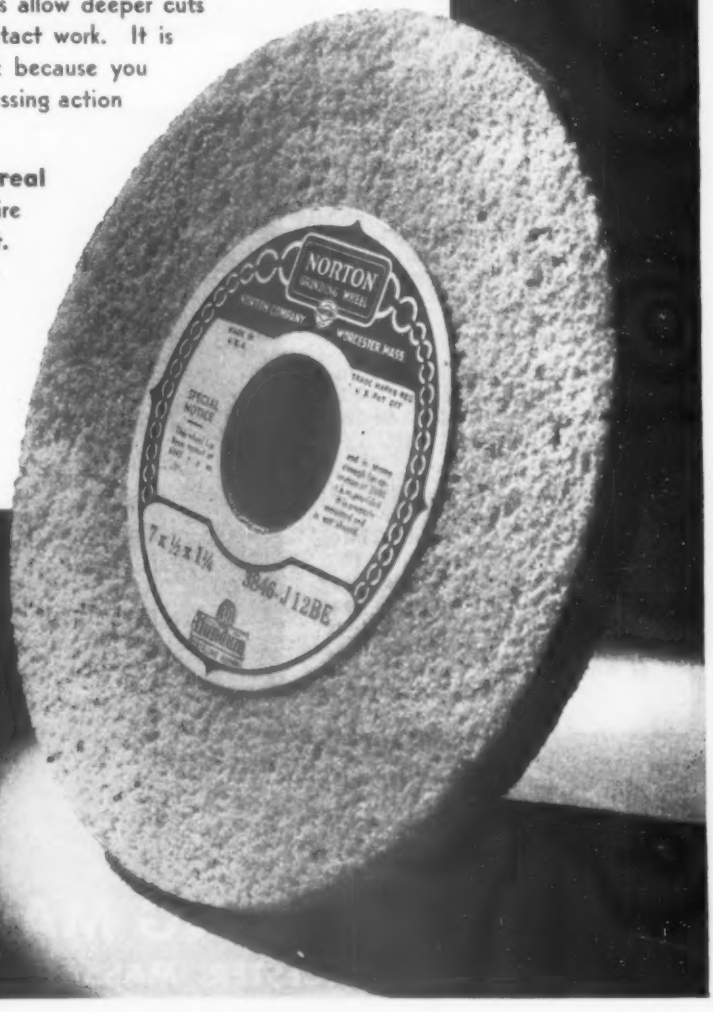


Hobs and Formed Cutters These often reach the tool room in such condition that considerable grinding must be done to restore them to service. This Norton No. 12 structure wheel is ideal for the work. It can be used in a grade hard enough to hold shape and still its large pores allow it to remove stock rapidly without burning.

Surface Grinding On this type of work the open structure wheel removes stock faster because the large pores allow deeper cuts without burning — especially on broad contact work. It is also good for jobs with interrupted contact because you can go to a harder wheel to get rid of the dressing action and still avoid burning.

This Norton No. 12 Structure wheel is a **real production booster** on jobs that require heavy stock removal with extra coolness of cut. But it is just one of several Norton structures available. Let Norton engineers study your grinding jobs and make sure that you are using the most suitable wheels — in abrasive and bond, grain and grade as well as structure.

W-908



NORTON COMPANY

WORCESTER • MASS.

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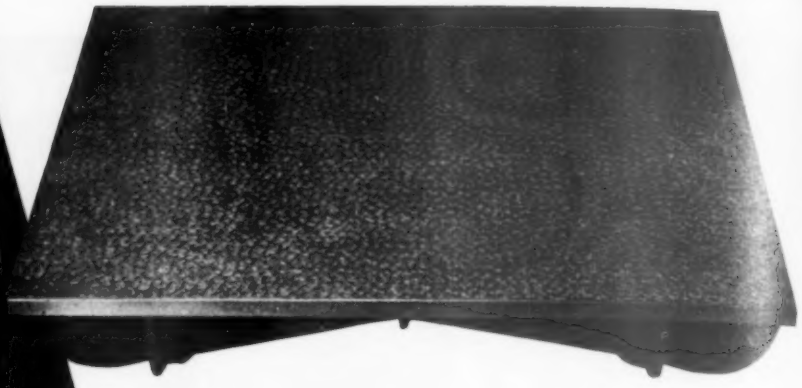
Distributors in All Principal Cities

NORTON ABRASIVES

SURFACE PLATES ANGLES and CUBES



Precision Scraped

These units are all made of Meehanite iron recognized for its dense, uniform grain structure and its unusual wear-resisting qualities.

This assures a smooth, flawless surface that increases efficiency of your inspection.

The surface plate has scientifically designed ribs to give absolute rigidity and strength to the entire surface.

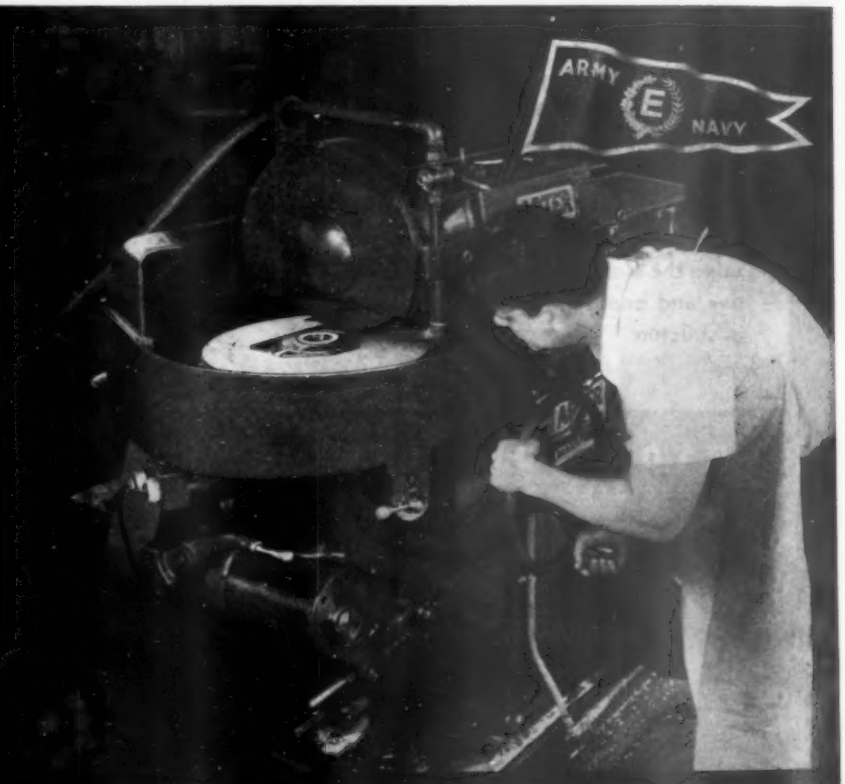
Send for complete folder giving sizes, weights, and prices.

MACHINE PRODUCTS CORPORATION
6775 EAST McNICHOLS ROAD • DETROIT, MICHIGAN

War-learned efficiency will create new competition, new and better products in the new world of the future when Victory is ours. New skills and new techniques are being developed.

In the new world of the future, precision-grinding — in quantity — will play an increasingly important part.

The makers of ARTER ROTARY SURFACE GRINDERS are looking into that future confident that the Arter developments in rotary surface grinding will help you in your precision production plans for the peacetime future of America.



ARTER

ARTER GRINDING MACHINE COMPANY
WORCESTER, MASSACHUSETTS • U. S. A.

USE THESE FREE REPLY CARDS

FREE INFORMATION and SERVICE

Request the information and service you desire and keep your library up-to-date . . .

THREE FREE SERVICES without obligation

For your convenience these three business reply cards enable you to request quickly

1:
New catalogs — bulletins listed in this issue.

2:
Additional information or bulletins relative to new equipment — new materials or new processes.

3:
When answering advertisements, specific information on problems or company representative's call.

HOW TO ORDER

Simply fill out the card, indicating the information or service you desire, and mail.

Be sure to write, in the square, the identifying number of the catalogs or bulletins covering new products described.

In answering an advertisement, include the name of the advertiser and indicate by a cross if literature is desired or if company representative should call. No stamp is required.

USE THIS CARD

for requesting new catalogs and bulletins listed in this issue.

USE THIS CARD

for requesting additional information or bulletins about new equipment, materials, processes, etc.

USE THIS CARD

when answering advertisements, to obtain specific information on problems, or when you desire a company representative to call.

Write in square, number of item describing one catalog wanted ▶ ☐

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THE TOOL ENGINEER, APRIL 1943

Write in square, number of item describing one catalog wanted ▶ ☐

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THE TOOL ENGINEER, APRIL 1943

NEW EQUIPMENT, Materials, Processing

T.M. REG. U.S. PAT. OFF.

HYDRAULIC TEST BENCH (K15)

Said to be principally used for checking aircraft tubing, the new stationary hydraulic test bench, recently announced by the Hydraulic Machinery Company, Inc., Detroit, has a variable test pressure of 0 up to 10,000 pounds per square inch and a variable delivery pumping unit of 0 to 12 gallons per minute.

This test bench, model T-102, can be used by two operators at a time. In an emergency, a third can work off of the accumulator hook-up. The accumulator is used for checking aircraft valves and can be operated at a maximum test pressure of 1000 pounds per square inch.

It is an air-oil accumulator—the air part of it being charged by a small, hydraulically driven, high pressure air compressor. A totally enclosed unit, it can be used to charge the accumulators on the planes themselves, according to the manufacturer.

It is claimed that this hydraulic test bench can be used to check anything in the way of hydraulic equipment before its assembly into aircraft. All the controls are accessible from the outside.

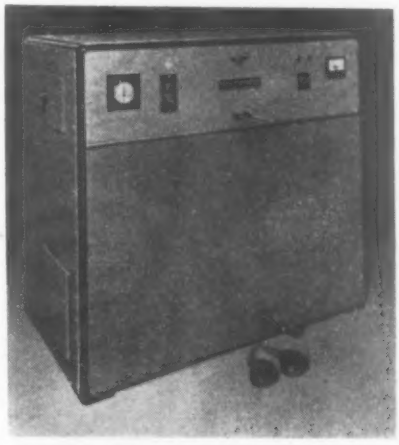
INDUCTION HEATING UNITS (K16)

Two new induction heating units for surface hardening, brazing, soldering, and other heating applications requiring localized heat have recently been announced by The Van Norman Machine Tool Company of Springfield, Mass.

Said to meet the average requirements of any plant, these units are available in two sizes, 16 KW and 32 KW. Each machine is a completely enclosed unit and is adaptable for low cost hardening and heating of parts in small lots or for any production line.

In operating the unit, the operator connects the proper heating coil for a particular job, sets the heat and quench cycle required, and work will be hardened, brazed, and soldered in a few seconds, it is claimed, with identical results.

In changing from one job to another,



Van Norman Induction Heating Unit
Entire heating operation automatic.

the operator changes the work-holding fixture and heating coil and resets the heating cycle to meet the new requirements.

Chance of human error is said to be eliminated because the entire heating operation is automatic and average shop workers, men or women, can easily learn to operate the units.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

Some of the advantages claimed by the manufacturer include uniform hardening, accurate results, increased output, and conservation of alloy steels.

DRILLING, REAMING, AND TAPPING MACHINE (K17)

Said to be designed especially for manufacturers of crankshafts whose total volume of shafts produced, although large, might be made up of several different models requiring many short runs of various setups, this new machine is made by the Le Maire Tool & Mfg. Co., Dearborn, Michigan.

Used for drilling, reaming, and tapping holes in flanges of crankshafts, this new machine is regarded by its manufacturers as a compromise between a single spindle setup and one having fixed spindle drill heads, in addition to individual fixtures, for various models of crankshafts to be machined.

Three horizontal spindles, spaced 120 degrees apart around a circle, can be spaced on any bolt circle diameter from 5½ to 10 inches. It is said to be possible to drill flanges having 3, 6, or 12 holes by indexing the head in which the spindles are mounted.

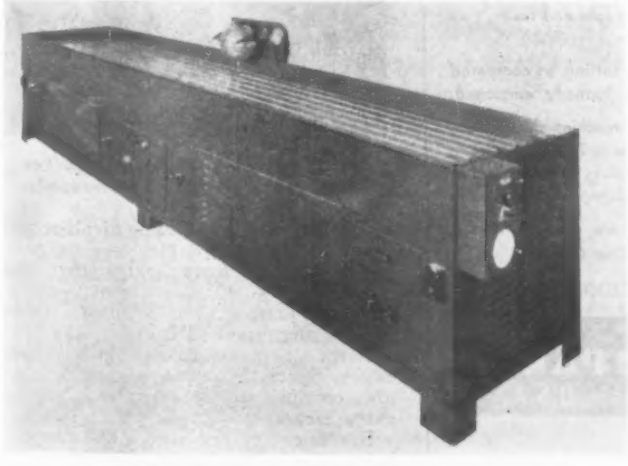
For drilling and reaming, the movement of the spindle head is controlled by hydraulic circuit, which allows rapid advance, coarse feed, fine feed, and rapid return.

For tapping, the hydraulic cylinder is disconnected and the taps are fed into the work by manual operation of the star handles. The taps are reversed by limit switch when the slide has moved the required distance.

The three operations, drilling, reaming, and tapping, can be performed on the machine with one setting.

CONE-POINT, CIRCULAR-PITCH TESTING FIXTURES (K18)

Two new devices for checking gears



A New Stationary Hydraulic Test Bench
It is used for checking aircraft tubing.

Machine for Drilling, Reaming, Tapping
Designed for crankshaft manufacturers.

were recently announced by The Fellows Gear Shaper Company of Springfield, Vermont. One is a cone-pointed testing fixture and is used for checking the concentricity of the pitch circle. The other fixture is used for checking the circular-pitch, or tooth to tooth spacing.

The maximum distance between centers is 15 inches and both fixtures have a maximum capacity for gears up to 12 inches pitch diameter.

These fixtures have a base upon which three adjustable brackets are mounted. The work-holding centers are carried by two of the brackets while the third bracket, which is located at right-angles to the other brackets, retains the measuring pointers, fingers, dial indicator, and indexing mechanism.

The bracket carrying the measuring pointers can be located in two positions. The spindles carrying the centers are adjusted through a rack and pinion and are clamped by levers. Clamping levers are also provided with the headstock and tailstock brackets. The work is automatically indexed by an indexing device that is connected to the lever operating the pointer holder. Indexing fingers are adjustable for different pitches and numbers of teeth.

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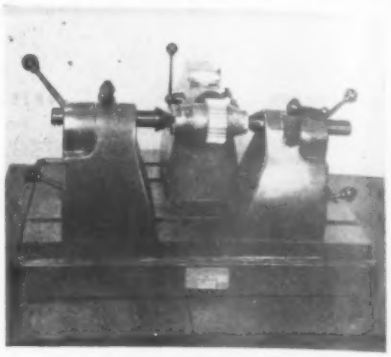


Cone-Pointed Testing Fixture
New device to check gears.

The measuring brackets for both types of testing are interchangeable in the same base. The manufacturer states that these fixtures are for use on a bench.

AUTOMATIC BUCKER *(K19)*

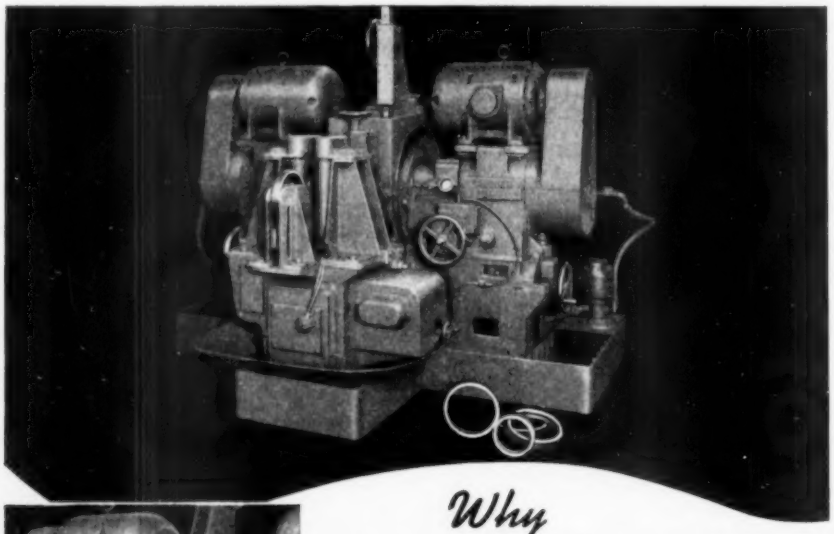
Simultaneous bucking and riveting is said to be possible with a new automatic bucker recently announced by the Aero Tool Company of Burbank, California. It is claimed that with this tool one operator can do the work of two previously required in riveting airplane and other sheet metal parts.

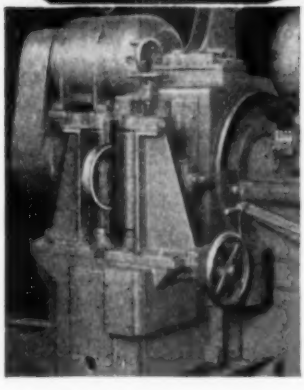
Aero Tool's New Automatic Bucker
Bucking and riveting simultaneous.

The manufacturer states that the construction of this bucker makes possible the driving of rivets instantly in perfect alignment. Parallel yokes provide for side panels, wings, and leading edges. Special yokes are used for engine cowling and other parts requiring extra clearance.

Rivets can be pre-loaded when working on horizontal structures. On vertical structures rivets can be inserted in

(Continued on page 168)





Why
GARDNER—GRINDING
definitely *cuts costs*
on parallel-surface parts like these!

TAKE a "tip" from the bearing industry, in which practically EVERY plant operates from one, to a battery, of Gardner PRECISION Double Grinders like the one illustrated here.

There are good reasons why this important industry has reduced its manufacturing costs on bearing rolls and races, thru GARDNER-GRINDING. Here they are:

1. TWO surfaces are ground at ONE setting, as compared to the single-surfacing operation formerly employed.
2. HIGH PRODUCTION — the 30" machine shown here, turns out huge 11¼" diameter races at 75 per hour complete in 3 cuts; other Gardner Grinders handle rollers at from 30 to 100 PER MINUTE, depending upon size.
3. CLOSE ACCURACIES — rollers are ground within a few "tenths" — true PRECISION Disc Grinding.

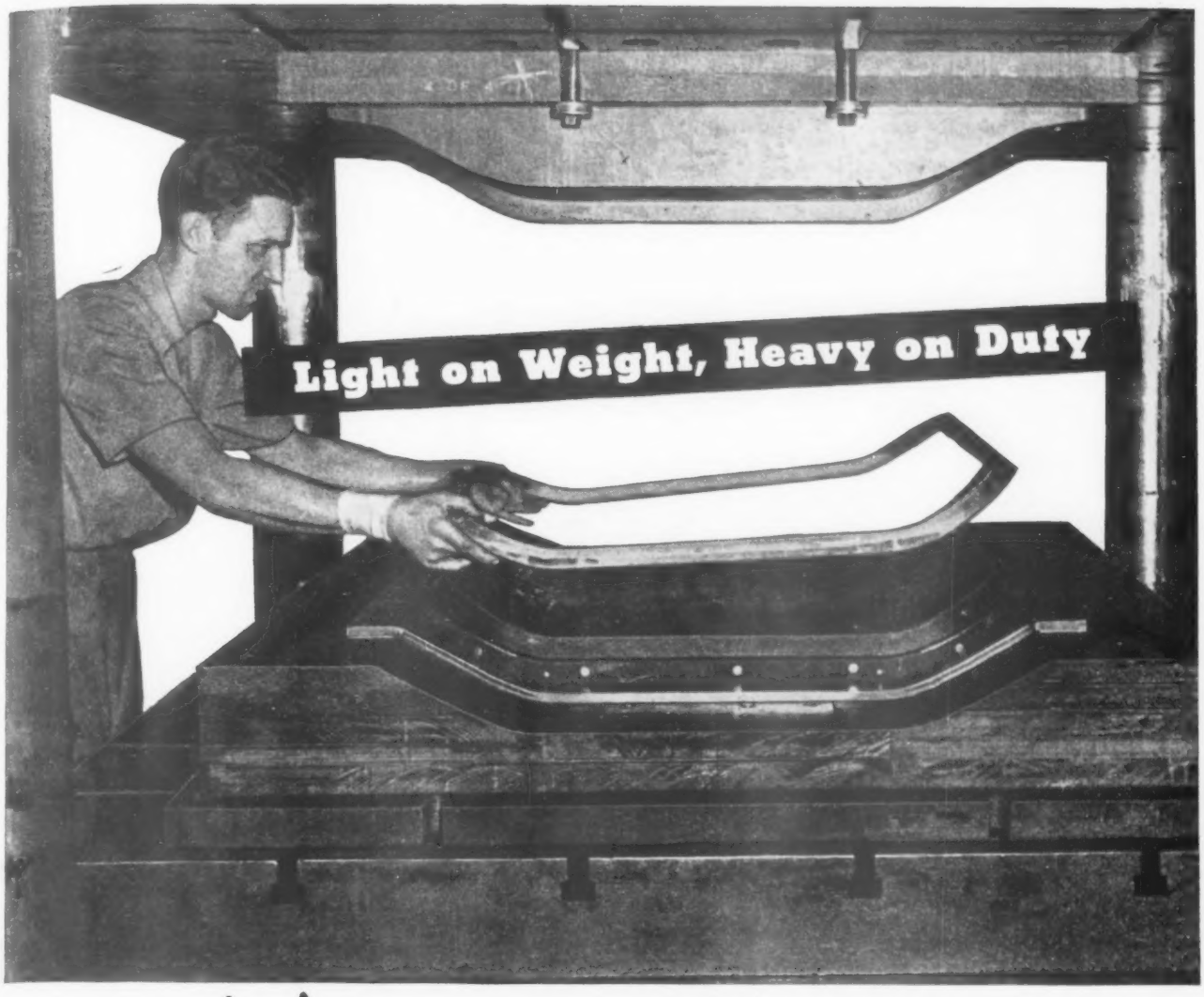
On this No. 848-30" Gardner Grinder, 11¼" diameter bearing races are ground at 75 per hour, complete in 3 cuts. TOLERANCES: .001"—.0015" for parallelism and ±.002" for uniformity.

Average-sized 4" diameter races are handled at 40 *per minute*, holding to .0003" to .0005" for parallelism.

Write for data on GARDNER PRECISION GRINDING!

GARDNER-GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY
442 East Gardner Street • • • • Beloit, Wisconsin, U.S.A.



• Deep-draw mating die of Masonite* Die Stock, used to produce hatch coaming part for Martin Patrol Bomber.

You'll be surprised—and pleasantly—with Masonite Die Stock . . . how a material so light in weight stands up for heavy-duty production runs.

Although only one-sixth the weight of steel, Masonite Die Stock has great compressive and flexural strength . . . is easily handled by pattern or tool maker . . . saves time, cuts fabricating costs.

This amazing semi-plastic material is popular in aircraft production, being used for shearing, forming, and shearing and forming in one operation, and also for router templates, drill jigs and assembly fixtures. For thicknesses greater than those available, Masonite Die Stock can be laminated with cold setting Urea-Formaldehyde glues.

If you want to cut costs, save steel and get into production in a hurry, you'll find Masonite Die Stock the practical material for your dies. It is readily available . . . comes in thicknesses of ¼ to 4 in. . . . in sizes of 48 x 72 in. and 48 x 144 in. For further details, mail the coupon below.

ARMY E NAVY

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MASONITE CORPORATION

Dept. TE-4, 111 West Washington Street, Chicago, Ill.

Please send me illustrative literature and complete information about Masonite Die Stock.

Name and firm _____

Address _____

City _____ *State* _____

the usual manner or pre-loaded and taped.

It is said that there is no yoke deflection and high grade seamless tubing and alloy steel castings are used. Tool with a 22 inch throat weighs 14 pounds while the one that has a 36 inch throat weighs 16 pounds, including gun.

INFORMATION FREE

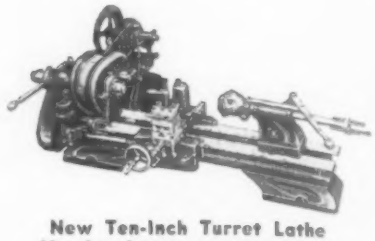
For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

The bucker is used with any standard rivet gun and can be furnished with specially designed heads for any type of aircraft construction. The opening and travel of the bucking bar are said to be limited only by the accessibility of the part to be riveted.

NEW UNIVERSAL TURRET LATHE-SCREW MACHINE (K20)

The F-series ten-inch lathe made by the Atlas Press Company, Dept. 7, Kalamazoo, Michigan can now be converted into a hand-type screw machine through production attachments now available. The addition of universal or independent chucks is said to adapt this equipment to turret lathe work.

The lathe production set-up as shown in the accompanying illustration includes: lever-type collet chuck; carriage turret with four-way tool post and back-slide tool post; tailstock turret for six operations; multi-stop attachment for gauging length of cut; reversing switch; and spindle nose cap.



New Ten-Inch Turret Lathe
Also hand-type screw machine.

The manufacturer states that the lathe is equipped with reversible power cross feed and longitudinal feed, complete V-belt drive, and tapered roller spindle bearings.

Specifications include a collet capacity of ½ inch; a swing over bed of 10¼ inches; and a thread cutting range, right and left, 4 to 96 (standard). It has 16 spindle speeds between 28 and 2072 rpm; four bed lengths available with a capacity of 18 to 36 inches between centers; carriage turret posts that take 3/8 inch cutter bits; and tailstock turret head that has six ¾ inch bored holes for tool holders.

NEW 1/4 INCH DRILL (K21)

The new model 47 Skildrill announced by Skilsaw, Inc., 5033-43 Elston Avenue, Chicago features a diecast body, helical-cut gears, and 100 percent antifriction bearings. The universal motor is available in four speeds—1800, 2500, 3500, and 5000 rpm.

This drill is said to be designed for

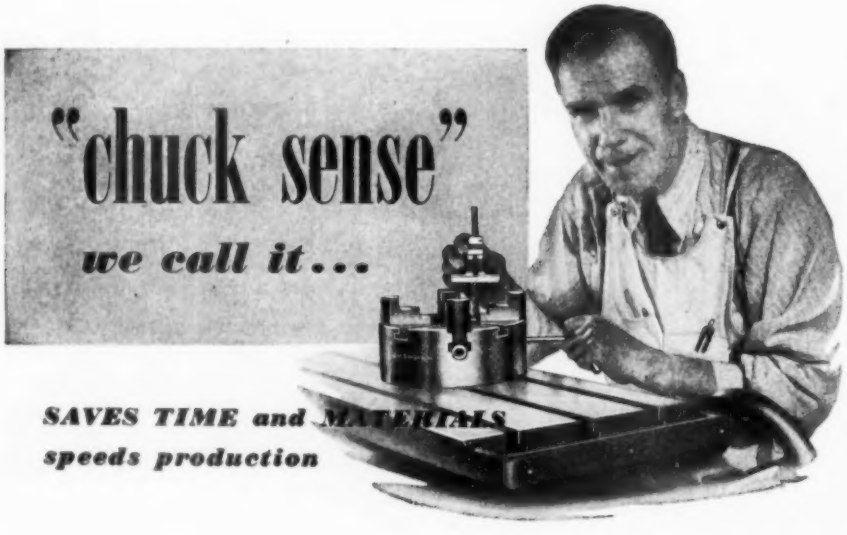
New Model 47 Skildrill
Used for "skin-drilling."

"skin-drilling" in airplane construction and can be used for many production drilling jobs up to ¼ inch in steel and ½ inch in wood. According to the manufacturer, this drill is small, light, and compact. It weighs 3½ pounds, is 7¼ inches long, and is 2-9/16 inches wide. It is claimed that it fits in any working space where a fist will and handles like pointing a finger.

MACHINE FOR TUBING OPERATIONS (K22)

A new machine was recently introduced by the Leonard Precision Prod-

(Continued on page 170)



As delivered to you on your new machine tool or for replacement, a Cushman Chuck is one of the most carefully designed, built and inspected pieces of equipment in your shop. It has been made to hold its high initial accuracy throughout a long service life. It is ready to turn out an impressive total volume of war material today and peace-time products tomorrow...if it is not abused.

Of course we realize that high production and possibly unskilled operators will result in a certain amount of "abuse". Cushman Chucks are built to "take it". But anybody can learn the simple fundamentals of good chuck maintenance and correct practice. There are just six simple rules printed on our "Chuck Check" cards that are available for your use. Write us today for the quantity you need. The Cushman Chuck Co., Hartford, Conn.

These small cards can be given to operators or put on bulletin boards. They'll help save time, save chucks and reduce spoilage.

CUSHMAN

A World Standard for PRECISION

High Speed Production

WITH TOOLROOM ACCURACY

War Production demands maximum speed and absolute precision. Both of these requirements are met in hundreds of war plants with South Bend Lathes.

Their rigidity and wide range of spindle speeds permit taking full advantage of the higher cutting speeds possible with tungsten-carbide tools. Their dependable accuracy makes it possible to machine work with such precision that subsequent finishing operations can often be omitted.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes, 9″ to 16″ swings. Write for a catalog and the name of our nearest distributor.

Use **THESE BOOKS AND FILMS ON LATHE OPERATION**

South Bend training helps — books, sound films, wall charts, and bulletins on the care and operation of a lathe — are available for training new operators. Write for Bulletin No. 21-C.

ARMY E NAVY

SOUTH BEND

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 36 YEARS SOUTH BEND, INDIANA, U.S.A.

ucts Company of Garden Grove, California, that is said to square, burr, flare, and bead ferrous and non-ferrous tubing.

The manufacturer states that it requires but a few moments to prepare the machine for any of the various operations. Ten sets of flaring dies and centers, squaring attachments, and burring attachments are standard equipment of the unit for tubing of ¼ inch to 1½ inch OD.

Working to either AC 811 or AND 10060 specifications, this machine is said to have reduced the percentage of rejections of coined, thinned, or imperfectly machined tubing. It is said to have been designed to speed up production by eliminating the need for hand tools and dies and that it produces work of uniform and consistent accuracy in all operations.

GRINDING FIXTURE (K23)

Said to speed up grinding operations as much as 300 percent, the new relief grinding fixture recently announced by Industrial Grinding Company of Los Angeles, California is a countersink grinding fixture and fits any standard grinder.

This fixture is said to handle countersinks of all types, center drills, integral pilot cutters and pilot-drills, right or left handed. With two wrenches, the fixture can be quickly adjusted for correct relief and angle in relation to the grinding wheel.

The fixture handles work from 1/16

New Relief Grinding Fixture
Fits any standard grinder.

to 1 inch in diameter with the standard collets that are available. The lift of the single cam is variable from .001 to ⅛ inch and adjustment pins are provided for 1, 2, 3, 4, 6, and 12 fluted cutter grinding.

One Hardinge type 5-C collet of ¼ inch capacity and two wrenches are included with the fixture which is ready for attachment to the grinder.

Construction is said to be extremely rugged. The main housing is cast iron, which supports a hardened and ground spindle on two large bearing surfaces that require only periodic oiling. The cam is hardened tool steel with steel adjustment pins. The fixture swings 90 degrees to the right or left and the base is calibrated in 5 degree increments.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

NEW TORQUE WRENCH (K24)

The new snap-acting torque wrench recently announced by Tubing Seal-Cap, Inc., 215 West 7th Street, Los Angeles gives both an audible and physical signal when the proper predetermined torque load is reached.

This new wrench is said to require no visual attention to operate as there are no dials or indicators involved. Thus the wrench can be operated in restricted areas where dials or indicators could not be seen. In operation, the wrench, when set to the desired predetermined torque load, gives a high-pitched, audible "click" and a physical signal in the palm of the operator's hand when the proper load is reached.

According to the manufacturer, the

(Continued on page 172)

Happy Workers are Seldom Absent

When workers enjoy their jobs they just simply don't want to be absent. And every good American enjoys his work if he understands it and can do it well. But today so many men and women who wish to give their best in the war effort are assigned tasks for which they are totally unskilled, with the result that they are unhappy.

◆ Management, in the stress of quickly getting into production, has sometimes ignored the good planning and proper tooling which would permit the use of unskilled labor with the least aggravation. In some instances the nuisance value of poor tooling has caused a turn-over in labor and an amount of absenteeism that rightly should not be chargeable to labor at all, but is primarily a management problem.

◆ La Salle engineers have worked with many great American companies in their wartime planning and tooling, in the development of fixtures that minimize the possibility of errors and that take the skill element out of the operation. In reducing tool aggravation, the worker becomes more satisfied with his job and is much less likely to absent himself from it.

◆ Perhaps your plant has a problem in tool, fixture, and special machine design, or in plant layout. No matter what your production need, La Salle will be glad to discuss it with you at no cost. Just write, wire, or phone us today.

LA SALLE DESIGNING CO., 628 W. Lake St., Chicago, Ill.
AL J. CONN, MANAGING DIRECTOR

LA SALLE

PRODUCTION AND MANAGEMENT ENGINEERING

It's That LAST OPERATION

OF THE SUNNEN PRECISION HONING MACHINE

that provides ACCURACY ★ INTERCHANGEABILITY ★ SUPER-SMOOTH FINISH

All of the care and skill used in previous operations — all of the vital materials used and the precious man-hours invested — are subject to costly waste if *that last operation* of honing or finishing is not one of dependable accuracy.

That's the reason why manufacturers of precious combat equipment and munitions have been quick to adopt Sunnen Precision Honing.

For here — in a small, inexpensive, economical-to-operate piece of equipment is the method that assures interchangeability of parts and fewer rejects, thanks to a guaranteed accuracy of .0001" and a super-smooth finish of 2 to 3 micro inches.

Versatile is the word for it — for this machine will handle any internal diameter from .185" to 2.400". No jigs or fixtures necessary. Can be set up in less than a minute. Skilled labor not needed — girls can be trained to handle jobs in "tenths" in a few hours' time.

A Sunnen engineer will gladly call and show you what Sunnen equipment can do on your job. Or write for free bulletin giving complete information.

SUNNEN PRODUCTS CO., 7932 Manchester Ave., St. Louis, Mo.

Canadian Factory: Chatham, Ontario

SUNNEN

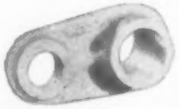
The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

Hardened Steel Inner Bearing Race honed to .00005" limit. Surface finish improved; errors of out-of-roundness eliminated.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

"Strict alignment maintained between two holes."

Drill Jig Bushing "Increases sales appeal of product."



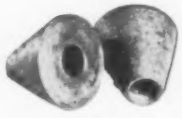
Aluminum Aircraft Link "produces high finish without bell-mouthing."

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Aircraft Valve Tappet Roller. 4-Micro finish.

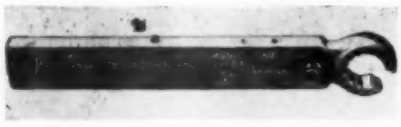
Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.



Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

wrench was designed primarily for applying the proper torque load to tubing "B" nuts in aircraft plumbing. It is said to eliminate the danger of pinching off



New Snap-Acting Torque Wrench
Has audible and physical signals.

or weakening flares thus reducing the possibilities of failures in aircraft hydraulic systems.

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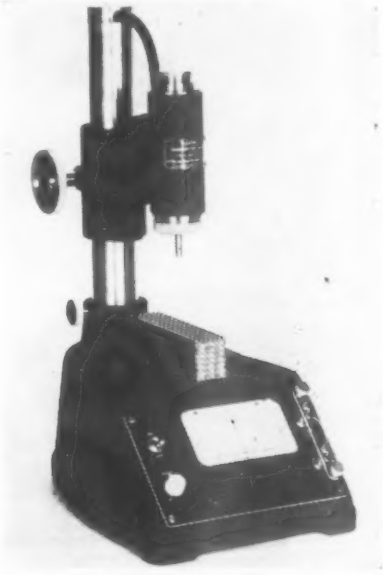
Marketed under the trade name of Livermont Torq-Snap, the wrench will be available in 12 sizes with open or box ends, either offset or straight. It is claimed that the wrench will eventually be available for additional uses such as engine base, cylinder head, and connecting rod bolts, spark plugs, wing, and break attach bolts.

ELECTRIC COMPARATOR GAGE (K25)

The new electric comparator gage recently announced by the Metron Instrument Company, 432 Lincoln Street, Denver, Colorado, is a four range precision measuring instrument said to be used for the rapid comparison of close tolerance machined parts, for the selective sorting of machined parts, for measuring taper and out-of-roundness, and for measuring shop tools and gages for accuracy and wear.



New Electric Comparator Gage
Has four ranges of sensitivity.

The manufacturer states that this gage can be set to size in less than 20 seconds with a master part or gage block. It has four ranges of sensitivity. The range of measurement actually marked on the scale is from 0.00001 inches to 0.004 inches. The four ranges are said to provide magnifications of 10,000, 5,000, 1,000, and 500 respectively.

Another feature is said to be the spindle pressure which is variable from two ounces to two pounds by rotation of a knob. Gage head swivels around the column and tilts at any angle to the vertical. Angle of tilt is indicated on a protractor.

Three size adjustments are provided for on the gage. The first is a rack and pinion elevating mechanism, the second is a vernier adjusting collar on the gage head, while the third is the electrical zero adjustment on the indicating unit.

COOLANT SYSTEMS (K26)

Three new coolant systems for machine tools, designed by the Reynolds Machinery Company of Providence, R. I., have recently been announced.

The first is called the 2-S coolant system and has an approximate 12 gallon capacity and a geared pump. Not equipped with a tank, this system has a ½ hp motor. According to the manufacturer, it is made in three models and is used on milling and screw ma-

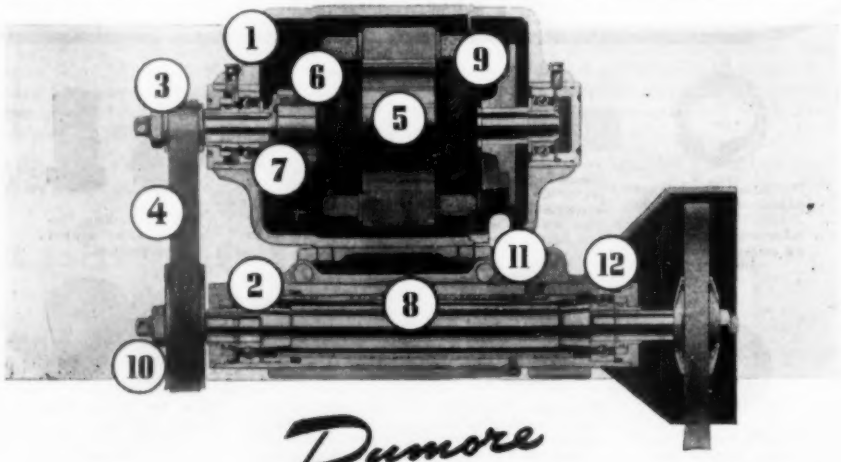
(Continued on page 174)

"It Takes a Tool that's Precision Built to Do Precision Work"

Just as water never rises higher than its source, so is the accuracy of your tool and die work limited by the accuracy of the tools, machines, and instruments you use. This is most important in your grinders, because grinding governs the most critical dimensions. Working to tolerances of one ten-thousandth is every-day practice with Dumore precision grinders, because these grinders are themselves built by craftsmen who work and think and talk in terms of a tenth. Equally important and equally accurate is the control of all inertia forces by dynamic balancing of supreme sensitivity — not by assemblies, but piece by piece and part by part. See for yourself the secrets of Dumore precision in the drawing below.

THE DUMORE COMPANY Dept. 223-D **Racine, Wis.**

1. MOTOR HOUSINGS are compact and sturdy . . . designed for easy portability.
2. PRE-LOAD SPRING assures smooth running bearings at high speeds. (Pat. 2,188,251.)
3. PULLEYS are balanced to increase belt life and give full power transmission.
4. ENDLESS DRIVE-BELTS, carefully selected for smoothness, are another aid to accuracy.
5. DYNAMIC BALANCING of armatures and rotating parts prevents vibration and increases precision.
6. PRE-EXPANDING armature windings, then double-dipping in enamel and baking them, prevents centrifugal "breathing."
7. LEAD WIRES are swaged to commutators by special Dumore process to assure 100% electrical contact permanently.
8. "FOG-OF-OIL" LUBRICATION to the quill bearings. A felt tube within the quill, extending to tapered ends of the main spindle, is held in place by a metal liner. Fingers at each end of the felt tube ride on the spindle surface, tapered to form an oil slinger. As the spindle revolves, it picks up a minute amount of oil from these fingers and the taper throws the oil into the bearings in a fog. (Pat. No. 1,859,068.)
9. FAN DRAWS air in through a filter, provides blast to keep both motor and quill cool.
10. AUTOMATIC BELT TENSION gives long belt life and maximum power transmission.
11. FRAME CONSTRUCTION assures rigid mounting, required in precision grinding.
12. BALL BEARINGS selected with infinite care for hours of vibrationless running.



Dumore

PRECISION GRINDERS

How to "Trouble Shoot" Tool Failures

The term "trouble shooting" has been aptly applied to the business of trying to find out why something went wrong. A good trouble shooter must be open minded and unprejudiced. He cannot first make up his mind what he "hopes" the trouble is—and then set out to prove he is right. Furthermore, he must be well informed on his subject. Discussed below are a few tips on tool trouble shooting that may be of help in your tool room.

Spalling in Service—Tools like header dies, coining dies, striking dies and embossing dies which are under heavy pressure must usually be made from a surface hardening tool steel. If they are made from a tool steel that hardens clear through, they are likely to split—they need the reenforcement of a tough core in order to hold together. If the hardened case is too shallow for the pressures involved, it will cave in like thin ice. This sinking action frequently progresses slowly—but eventually a chip will come loose and this is known as spalling. An example is shown in Figure 1.

FIG. 1

The remedy for this is to use a higher hardening heat, or a flush quench, or both, to drive the hardness penetration deeper. Failing in this, use a steel having slightly deeper hardening characteristics.

Heat Checks—In the red-hard tool steels used for hot forming operations, the working surface of the tool will frequently become crazed with a pattern that is suggestive of grinding checks. When a tool is in contact with the heated work, it is *suddenly heated*. If a liquid coolant is used, the minute the hot forging is removed the surface is *rapidly chilled*. This process is repeated many times and finally the surface starts to heat check. A badly checked hot drawing mandrel is shown in Figure 2.

FIG. 2

Heat checking can be greatly helped by not employing so violent a coolant. A stream of water can be replaced by an air blast. Also, a tool that has been drawn back far enough to have some ductility will resist heat checking better than a harder tool.

Grinding Checks—Grinding checks so fine that they cannot be seen with the naked eye can so weaken a tool that it may later fail in service. Figure 3 shows a tool with grinding checks that has been boiled in acid to make them visible. If this tool were to fail as a result of grinding checks, the edge of the fracture would follow the path of some of the checks. This makes a characteristic jagged edge to the fracture which should immediately suggest grinding checks. Boiling the tool in acid will make them visible.

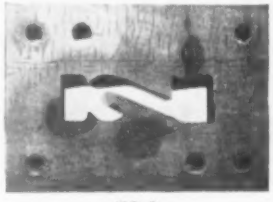


FIG. 3

Obviously, all grinding checks are not the fault of the grinder. If he receives a poorly hardened and poorly drawn tool that is almost ready to fall apart when he gets it, he cannot grind it successfully, no matter how careful he may be. On the other hand, it is so easy to hog into the work on the roughing cuts that many *good* tools are ruined in grinding.

Machining—It is well to be suspicious of tools from which large amounts of metal have been cut, and those that have deep, sharp stamp marks. In case of doubt, it is better to be on the safe side and give such tools a strain relieving anneal before hardening them. Figure 4 shows a pneumatic chisel that failed in service from fatigue that started in a deep stamp mark.

FIG. 4

These tips on trouble shooting were extracted from "Tool Steel Simplified". They are just part of *one* chapter of the book. Put *all* the useful facts on many subjects in this book to work for *you*—right in your tool room. Order copies for the tool room men you want to train—for your "trouble shooters"—today.

THE CARPENTER STEEL COMPANY, 122 BERN STREET, READING, PA.

"TOOL STEEL SIMPLIFIED"

315 pages, 105 illustrations. Available at cost in the U. S. A.—$1.00 a copy ($3.50 elsewhere).

More than 35,500 copies of "Tool Steel Simplified" are now being used in plants like yours to train new men, "up-grade" older hands, save time, trouble shoot—get better and faster production.

Carpenter MATCHED TOOL STEELS

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chines and lathes using coolant and cutting oils.

The No. 1-S system has approximately a 7 gallon capacity, a 16 by 10 by 11 inch tank, and a geared pump. This model is equipped with a ¼ hp motor.

The third coolant system is No. 206 and is said to be designed for use on grinding machines, multiple spindle drills, and machinery using water and soluble oil solutions. It has approximately a 15 gallon capacity, a tank size of 20 by 16 by 16 inches, a rotary pump, and a ¼ hp motor.

PINION CUTTER (K27)

Through some changes in the machine and the application of a motor drive, the pinion cutter manufactured by Waltham Machine Works of Waltham, Massachusetts in addition to cutting pinions is now being used for cutting teeth on sectors, slotting ends of tap screws, milling flutes on small taps, milling grooves on special scoring tools, milling flats on various items, and squaring ends of taps or rods.

According to the manufacturer, these machines are now made with adjustment to give variable stroke lengths.

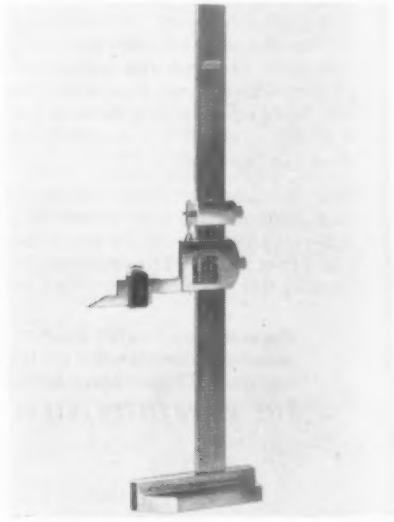
Latest Waltham Pinion Cutter
Changes made in the machine.

Strokes of 3/16 to 1-3/16 inches can be taken. This same adjustment permits setting of machines so that short strokes can be taken at any point of the work and not just at the end of strokes.

Another feature is said to be the fact that automatic indexes permit indexing for any number of positions and uneven spacing can easily be taken care of. The magazine can be arranged for hand feeding or magazine feeding.

NEW VERNIER HEIGHT GAGE (K28)

The new vernier height gage recently announced by the Jansson Gage Company, 19208 Glendale Avenue, Detroit is made in three standard sizes — 12, 18, and 24 inches. The gages can be had in either English or metric measure.



New Jansson Vernier Height Gage
Used in jig and fixture making.

The manufacturer states that these new height gages are designed especially for use in jig and fixture making and for general layout and inspection work.

Exceptional precision is said to enter into their calibration, making these gages valuable adjuncts to gage blocks

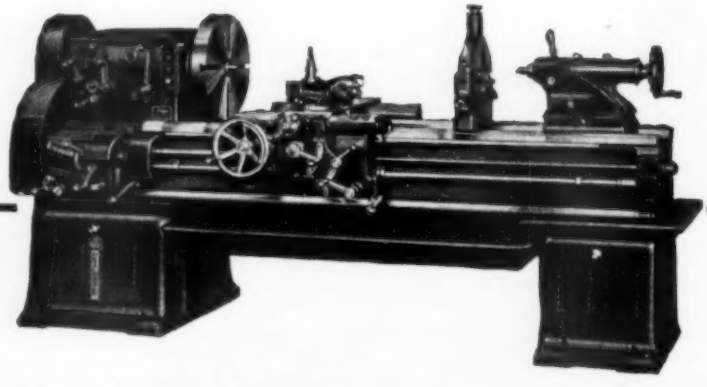
(Continued on page 176)

THE BRADFORD TRADEMARK

Represents

Over 100 Years of Experience

Building Metal Working Machinery

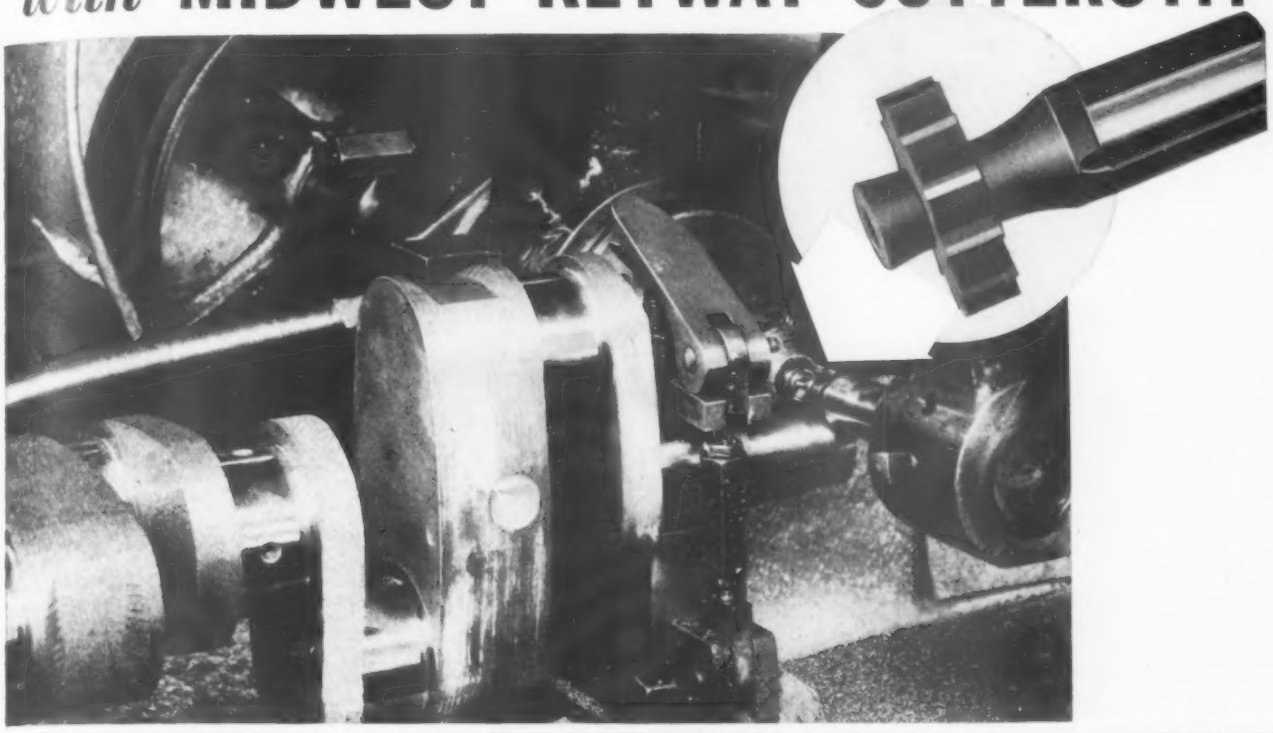


The Metalmaster Lathe represents the very last word in Bradford design and engineering skill. The result of more than 100 years experience in building metal working machinery, the Metalmaster is definitely the lathe for precision work in your War Plant. Such features as 12 speeds in both forward and reverse directions and precision made spindles to insure perfect running balance are found in this lathe. Write us today for complete specifications.

ALSO MANUFACTURERS OF DRILLING AND TAPPING EQUIPMENT

THE BRADFORD MACHINE TOOL CO.
EVANS STREET SOUTH OF EIGHTH, CINCINNATI, OHIO
PRECISION TOOLS SINCE 1840

You can take heavier cuts at Faster Speeds with MIDWEST KEYWAY CUTTERS...

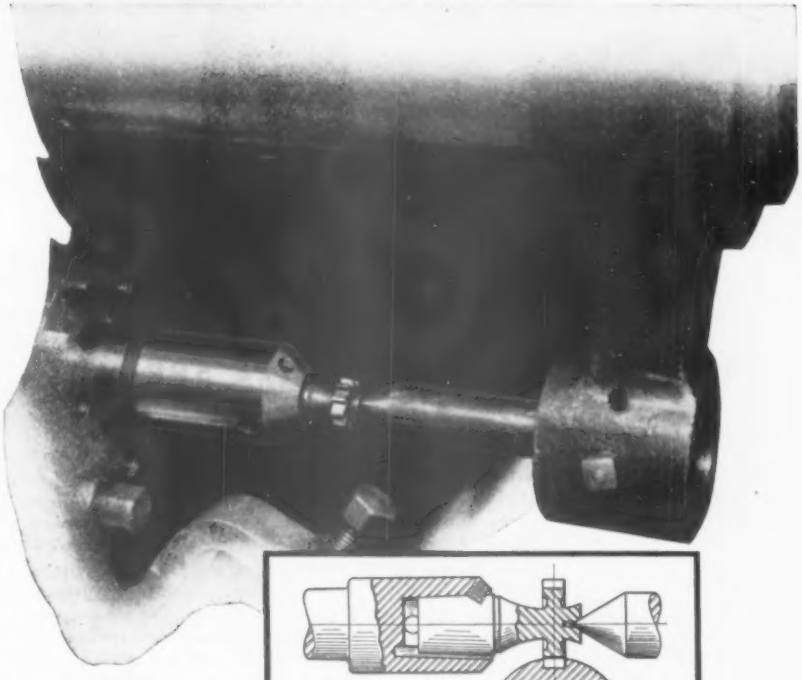


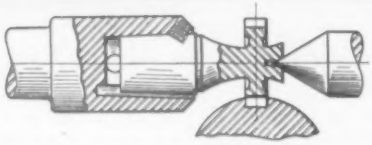
Here are 3 important reasons *why*—

1—SUPPORTED AT BOTH ENDS—the cutter is made with an extended center which provides a support for it at the outer end, thus both ends of the cutter are supported, giving absolute rigidity to the operation.

2—THE POSITIVE DRIVE—Midwest Cutters have a stub taper shank with a groove to fit a pin that is partly embedded in the wall of Midwest patented Taper and Pin Drive Holders. Full driving energy is exerted along the entire length of the shank, giving the cutter absolute rigidity and perfect alignment. No parts easily dislocated or lost are employed.

3—SCREW LOCKED—the cutter shank is designed for positive locking to the holder by a lock-screw which bears against the angular flat on the shank of the cutter. Cutter vibration is eliminated.





This sectional view of a Midwest Keyway Cutter set-up shows the Extended Center which provides an outer support for the cutter; the Taper and Pin Drive; and the Screw-Lock between the cutter shank and holder.

MIDWEST TOOL & MFG. CO.
2364 W. Jefferson Ave. • Detroit, Mich.

MIDWEST

END MILLS • SLEEVES • COUNTERBORES • DRILLS • SPECIAL TOOLS
REAMERS • FORM TOOLS • CARBIDE TIPPED TOOLS • ADJUSTABLE HOLDERS

BUY U. S. DEFENSE SAVINGS BONDS AND STAMPS

Precision METAL CUTTING TOOLS

in angle measurement and other operations where accuracy is required.

NEW MAGNETIC ADAPTER (K29)

Said to make possible a wide scope of applications in set-up and inspection layouts, a new magnetic adapter for dial test indicators, surface gages, and gage block applications has been announced by the Windermere Manufacturing Company, Inc., 205 East 42nd Street, New York City.

When the upright center post and collar are removed, the adapter is transformed from an indicator holder to a general work holding block. The manufacturer states that it may be used to anchor parallel, angle iron, and work pieces in any given position. It is said that this is made possible by the fact that magnetic qualities are the same at both bottom and top.

The holding power is sufficient on the top and bottom to provide a solid anchor and eliminates clamps and special holders. It is claimed that it will last indefinitely without loss of strength.

This magnetic adapter comes in one standard size. The weight is approximately 20 ounces and the upright center post is available in either 3/8 or 5/16 inch sizes.

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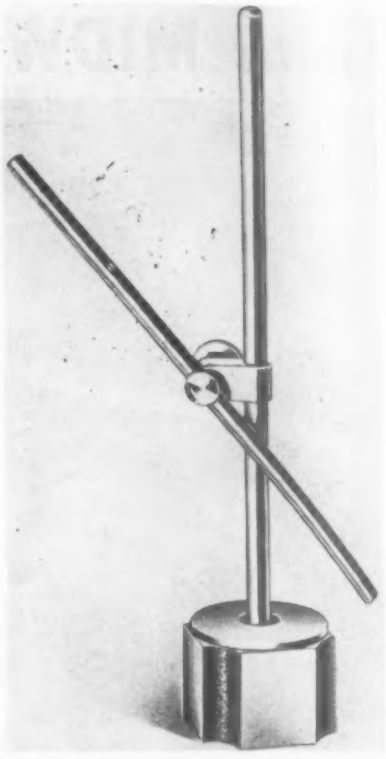


New Windermere Magnetic Adapter
Has wide scope of applications.

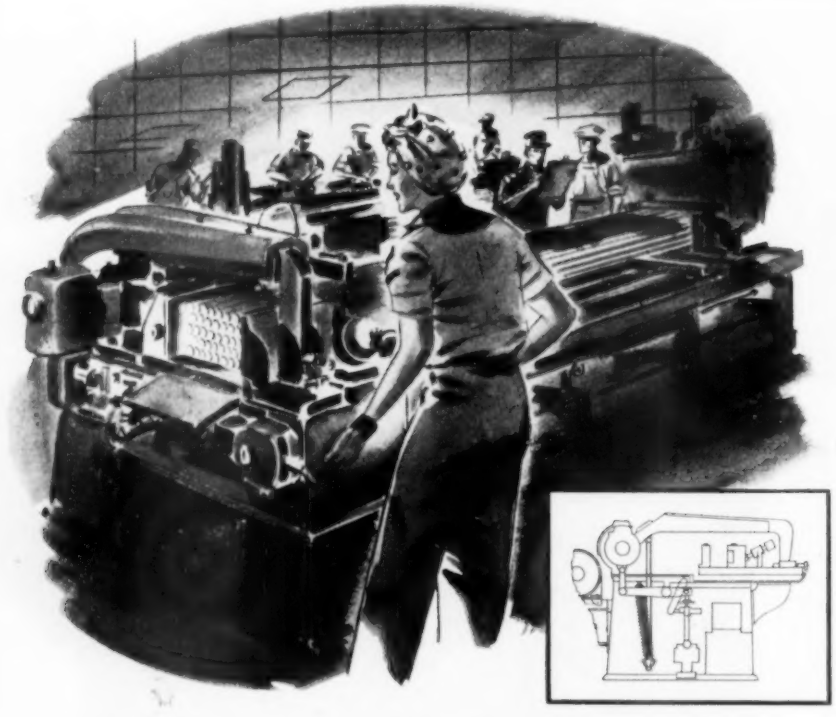
NEW PORTABLE ELECTRIC DRILL (K30)

A new plastic ¼ inch portable electric drill was recently announced by Independent Pneumatic Tool Company of Chicago. First public announcement of this new Thor drill follows nearly a year in which large quantities were produced under Army contract.

New Portable Electric Drill
Constructed of a new plastic.

The grip handle, field case, and gear case of the drill are constructed of a new plastic. Said to be tough, yet light in weight, this plastic is called "Thorite" and was developed in the laboratories of this concern.

(Continued on page 178)



THE BIG JOB OF A LITTLE SPRING

IN MASS WAR PRODUCTION!

★ Seldom noticed, perhaps, is the counterbalance spring of the Racine High Speed Saw, shown above. But what an important part it plays in 24-hour-a-day production schedules!

Designed especially for this heavy-duty saw by Muehlhausen spring technicians, it is a vital part of the simplified finger-tip control, which speeds up production by cutting down handling and loading time. This spring has all the ruggedness to withstand the rough treatment of unskilled men, yet has the accuracy required for counterbalancing—so necessary for ease of manipulation by women operators.

You can always depend upon Muehlhausen to produce springs of unvarying precision and accuracy for any application; springs of any type—compression, extension, torsion or flat—hot or cold formed. Call, write or wire for facts today!

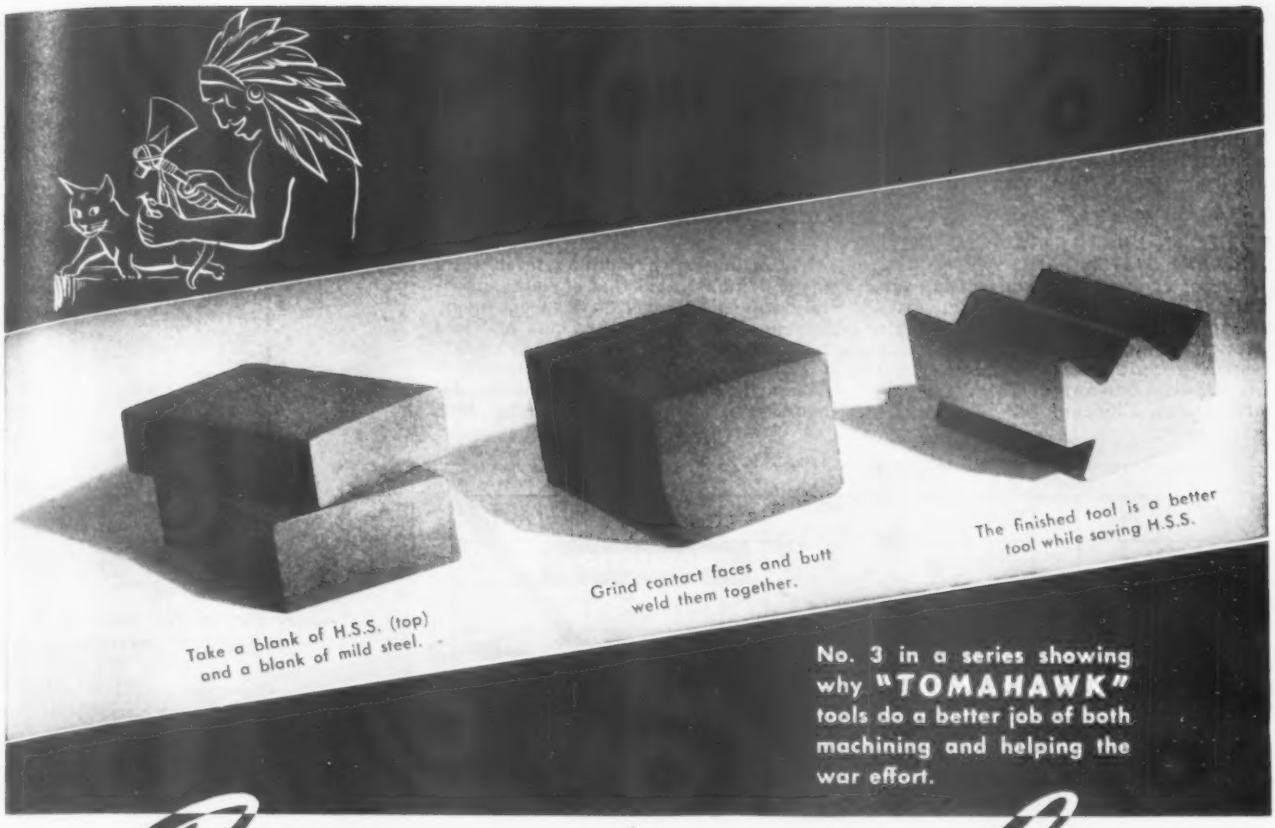
MUEHLHAUSEN SPRING CORPORATION
Division of Standard Steel Spring Company
625 Michigan Avenue, Logansport, Ind.

MUEHLHAUSEN SPRINGS
EVERY TYPE AND SIZE

SEND FOR NEW FOLDERS—FREE

New Die Spring Bulletin illustrates, describes 206 sizes and types of die springs.

New Armament Bulletin shows importance of springs for many types of war equipment.


Take a blank of H.S.S. (top) and a blank of mild steel.
Grind contact faces and butt weld them together.
The finished tool is a better tool while saving H.S.S.
No. 3 in a series showing why "TOMAHAWK" tools do a better job of both machining and helping the war effort.

Putting skin on a Cat .....or on a Tool.....

Just as there is more than one way to skin a cat, so there is more than one way to save critical tungsten and still make better tools.

There is a total of less than 2 per cent of critical tungsten in the complete **TOMAHAWK** tool type★ shown at the right. The reason: it has been fabricated by electrically welding High Speed Steel to mild steel, prior to machining, heat-treating, and grinding. The net saving of tungsten usually runs 50 to 75% as compared with tools of solid H. S. S.

The **TOMAHAWK** tool shown is 'hard' where hardness is required (at the cutting edges), and is 'tough' where toughness is important (at the dovetail).

Perfection of welding and heat-treating techniques have been carried to such a point today that failures of such tools at the weld are virtually unknown. Thousands of electrically welded composite steel **TOMAHAWK** tools are now in use in war production industries.

★*Genesee produces a complete line of cutting tools, including H.S.S., carbides, etc. Send for "streamlined" catalog No. GT-42-* **TE**

GENESEE TOOL COMPANY

FENTON, MICHIGAN

★ Registered Trade Mark

According to the manufacturer, tests made by the concern's engineering department found the drill to have such features as more power per pound, greater strength and protection from shock, lighter in weight, and cooler to handle.

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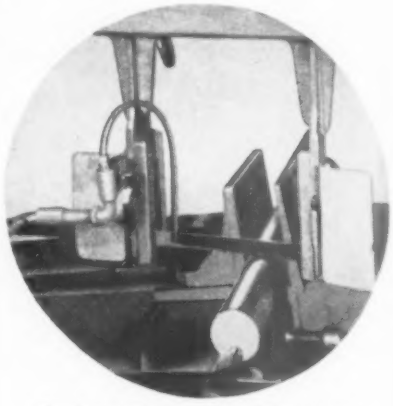
HORIZONTAL BAND SAW COOLANT SYSTEM (K31)

Use of coolants in metal cutting operations on horizontal type band saws is said to have been made possible through the application of a new coolant system recently announced by the Gray-Mills Company of 213 West Ontario Street, Chicago.

According to the manufacturer, tests made demonstrated that coolants, properly applied, allowed saw speeds to be increased, with smoother cuts and less blade wear.

Called the Model S-20, this system is designed to fit all types of horizontal band saws. It includes a Gray-Mills pump mounted in a coolant return pan which is attached to the legs of the machine. All fluid is caught by the pan and returned to the pump for recirculation. Anti-splash shields guard the pump and operator from the oil.

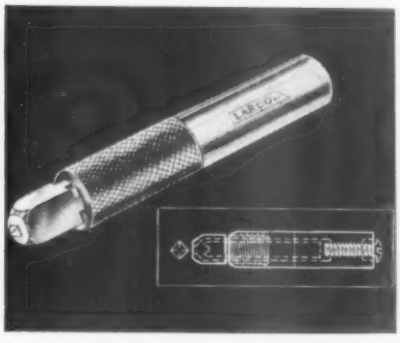


Coolant System for Band Saws
Tube slotted to fit over blade.

An unusual feature is said to be found in the oil feed tube which is slotted to fit the saw blade, assuring a full distribution of oil over the blade. The entire system is said to be easily attached or removed. No drilling or alteration of the saw is necessary.

DIAMOND TOOL WITH PATENTED SHANK (K32)

This new diamond tool is the product of the Larco Tool Division of Louis A. Roselaar, 551 Fifth Avenue, New York City. It is claimed that the tool is designed so that on any of the six interchanges of point, the octahedron diamond is always in dead-center.



New "Plus-Five" Diamond Tool
Features a patented shank.

Trade named the "Plus-Five", this tool comes with either one cap for a specified size diamond or with several caps to take several sizes. The holder may be retained indefinitely for continuous use on dressing jobs.

According to the manufacturer, the operator can speedily reset the point of the diamond himself and there is no need to send the tool back for resetting or to carry a reserve tool stock.

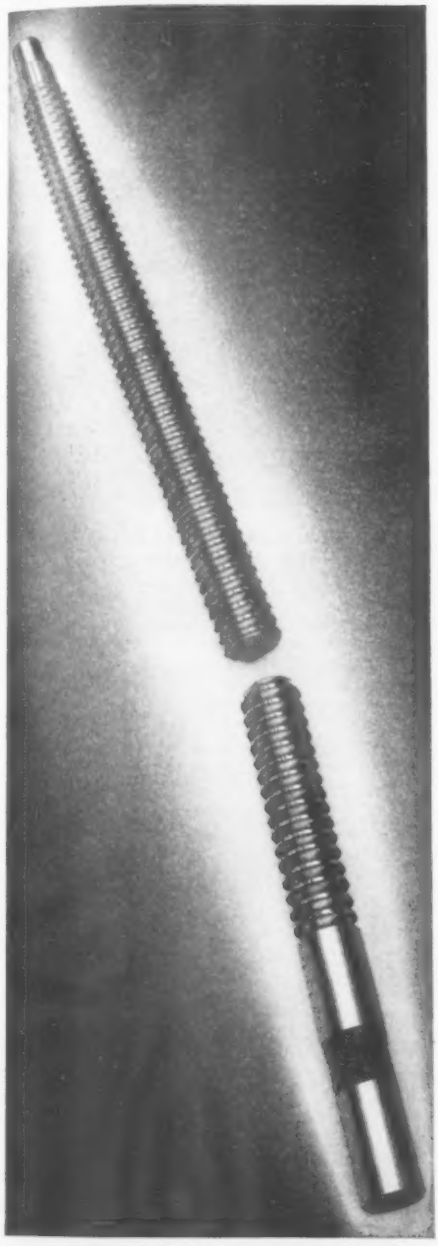
PROTECTIVE DUST MASK (K33)

Recommended for protection against non-toxic dusts except free silica and asbestos, the dust mask manufactured

(Continued on page 180)

PRODUCTION
PRODUCTION CHARTS GO UP WITH Avey DRILLING EQUIPMENT
Your installation of our Avey Automatic equipment assures you—increased speed in production. This Standard No. 1 Cam Feed Unit Machine, with Drill Head and Automatic Index fixture, is adaptable to many operations including Drilling, Reaming, Counter Boring and Tapping. Send us prints of your requirements.
PRODUCTION: 2000 parts per hour, drilling two parts in each station, using No. 50 Drills.
MATERIAL: Brass.
THE AVEY DRILLING MACHINE CO.
Cincinnati, Ohio, U.S.A.
Avey DRILLING MACHINES
CINCINNATI · OHIO

2 SECONDS
would have saved this broach . . . . .



It may take 100 days to get a new one

How to get more production with your Broaches------

4. BY PROPER ALIGNMENT

It only takes a second or two to make sure that the piece to be broached is PROPERLY AND SECURELY seated in the fixture.

When parts are not securely seated they may "jump" into place while the broach is moving. If this happens the part tends to "cock" and jam against the broach, frequently resulting in tooth breakage if not breakage of the broach itself.

And, when you are broaching a cored or forged hole from the rough, it is safest to use an equalizing fixture to avoid localized high tooth loads tending to force the broach out of alignment.

For the same reason, a drilled hole should be square with the face or surface of the part against which it is located in the broaching fixture.

Simple precautions such as these will enable you to reduce broach breakage, reduce tool costs, and avoid production tie-ups.

Write for a copy of "Broaching News" Vol. IV, No. 8 for further details on "How to Get the Most Out of Your Broaches".

colonial BROACH COMPANY

Broaching Machines *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

by The Martindale Electric Company of 1421 Hird Avenue, Cleveland now uses a pre-formed plastic frame instead of aluminum or zinc.

According to the manufacturer, this is another example where the shortage of metals has produced a substitute superior to the original. The use of plastic has reduced the weight of the mask. No change has been necessary in the interchangeable refills used with the mask since the type of filtering remains the same.

CARBIDE TOOL GRINDERS (K34)

The accompanying illustration shows the Hammond 4-B combination chip breaker and cup wheel grinder, one of two new belted type carbide tool grinders recently announced by Hammond Machinery Builders, Inc., 1636 Douglas Avenue, Kalamazoo, Michigan.

This model 4-B is equipped with a multi-V-belt drive with which there are no electrical specification limitations, it is claimed. According to the manufacturer, this machine is vibrationless and is equipped with ball bearing spindle and oversize bearings which are permanently grease sealed.

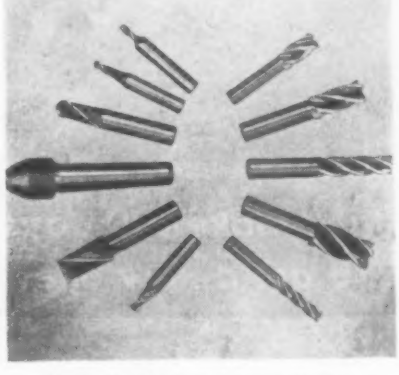
Wheel construction includes drip feed tanks with adjustable valves for diamond wheel grinding. Another feature of these new machines is said to be an angle vise of double cradle design. The silicon carbide cup wheel is on the left side of the machine along with an 8 by 14 inch tilting table. The chip breaker is on the right side.

New Carbide Tool Grinder
Has a multi-V-belt drive.

NEW END MILLS (K35)

According to a recent announcement, large scale production is now in progress on Fray Kurl Kut End Mills made by Fray Tool & Reamer Company of Glendale, California. The manufacturer states that these end mills come in 11 different styles and that each style is designed for a specific purpose.

It is claimed that they are made of the finest high speed tool steel, individually heat treated for the size and type of cutter and work for which they will be used. Some of the types included in this group are single-end end mills; 2-flute end mills; ball end mills; fluted chucking reamers with straight shanks; rose chucking reamers with straight shanks; collets, all straight shank; solid counterbores; and end mill holders.



New End Mills In Eleven Styles.
Each designed for a specific job.

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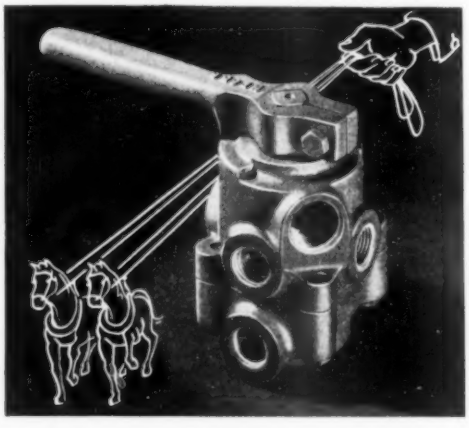
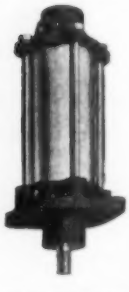
Control SIMPLIFIED!



* NOPAK Dual 4-Way Valve Controls Two Cylinders with One Lever

* Embodies NOPAK Patented Cored-Disc Principle and other famous NOPAK features.



NOPAK CYLINDERS —for Air or Low Pressure Hydraulic Power, available in Standard and Heavy Duty Types, with Adjustable or self-Regulating Cushions. 6 Standard Mountings.

This sturdy, compact, NOPAK Valve can take the place of two four-way valves in applications where two double-acting cylinders are used in close relationship to one another. The four independent outlet ports are arranged so that two cylinders may be operated in either direction in any sequence required.

With this valve a variety of operating cycles may be set up, and controlled with a single lever. This is an advantage where inter-dependent machine movements must be accurately governed.

The Dual 4-Way gives you the operating advantages you have learned to expect of all NOPAK Valves . . . long-lived, maintenance-free service, precision control, easy finger-touch operation.

If "one lever control" of two cylinder movements would result in simplified operation, write for further information.

GALLAND-HENNING MFG. CO.
2757 S. 31st Street Milwaukee, Wis.

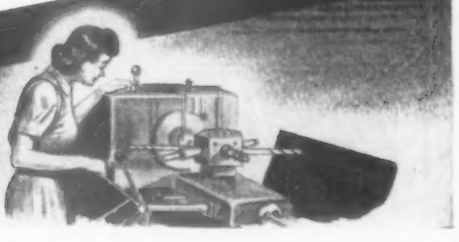
Representatives in Principal Cities

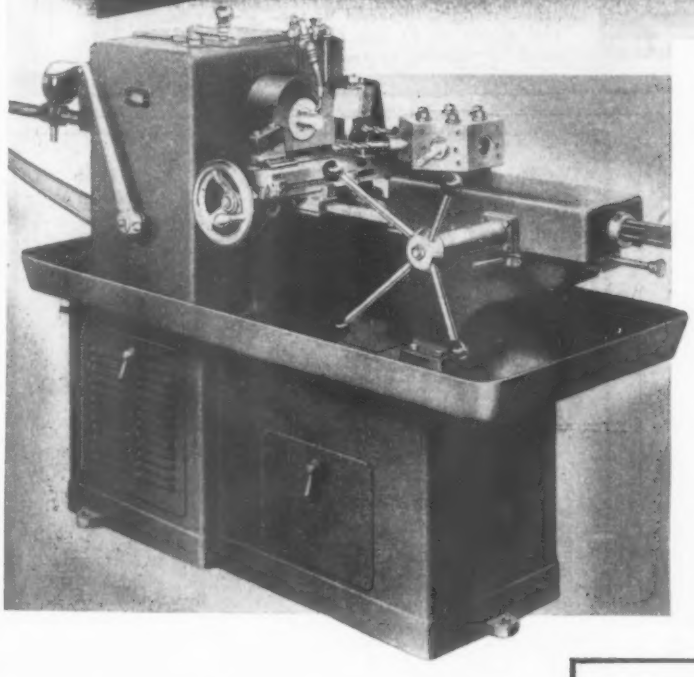
NOPAK VALVES and CYLINDERS
DESIGNED for AIR or HYDRAULIC SERVICE

SIMPLICITY

of the Oster No. 601 RAPIDUCTION LATHE

Speeds Training of New Operators





Certainly you can't turn new operators loose on complicated machines. But you CAN relieve the pressure on their highly trained operators by diverting a wide variety of small diameter bar and chucking jobs to Oster No. 601 "RAPIDUCTION" Lathes.

This SIMPLIFIED machine is easy for the beginner to understand and operate efficiently after a short training period.

Ample proof of that statement is available. For example, one manufacturer has 139 Oster No. 601 Lathes operated mostly by people without prior machine shop experience.

For quick response to your request for complete details on the Oster No. 601 "RAPIDUCTION" Lathe, use convenient form below*.

No Time Out to Celebrate Our
50th
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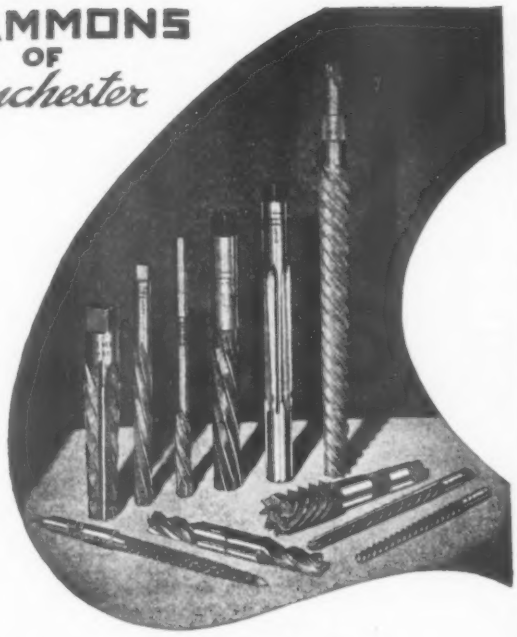

PRODUCTION TOOLS

ORIGINATORS AND
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FLUTED TAPER PIN REAMERS

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can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, brouches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.

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NEW LITERATURE *

OF INTEREST TO PRODUCTION EXECUTIVES

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(679) Comparator

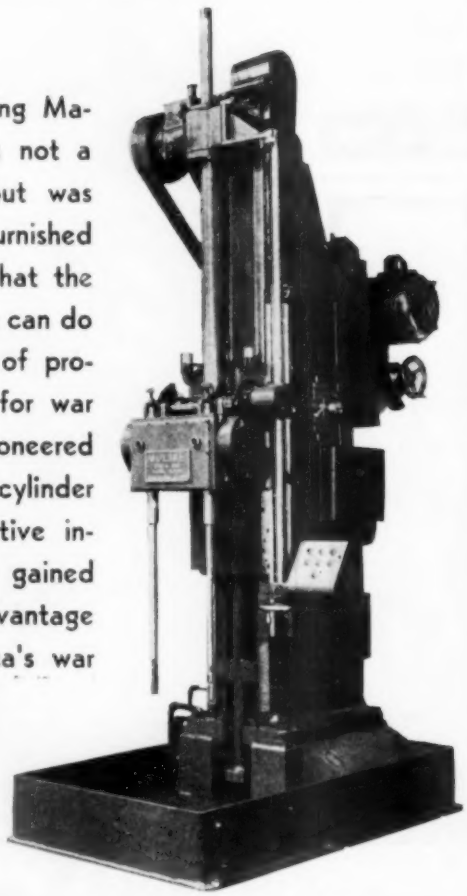
Electrolimit External Comparators. 20 pp. Pratt & Whitney, West Hartford, Conn. This new booklet has many illustrations showing both the standard and master models at work. The electrolimit height gage, the electrolimit snap gage, the mechanical external comparator, and the electrolimit gage block comparator are also described and illustrated in the booklet.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

ENGINEERED TO SUIT THE JOB

The Moline HL21 Honing Machine illustrated here is not a "standard" machine, but was designed, built and furnished with Moline hones so that the operator of the machine can do the most efficient job of producing standard parts for war equipment. Moline pioneered in the development of cylinder honing for the automotive industry and experience gained then is being used to advantage now in helping America's war machine to keep rolling.



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MOLINE, ILLINOIS **ESTABLISHED 1901**

(680) Control Panel

Vickers "Traverse and Feed Cycle" Control Panels. 16 pp. Vickers Incorporated, 1400 Oakman Blvd., Detroit. Description of operation, features, and installation of these control panels plus many photographs and line drawings are found in this new bulletin. Models, capacities, and prices are listed and typical applications are shown.

(681) Adjustable Dies

Adjustable Dies, Production Tools, and Special Machinery. S. B. Whistler & Sons, Inc., 752-756 Military Road, Buffalo, N. Y. This is the 25th anniversary edition of a completely illustrated catalog. It contains information on dies and their use as well as other Whistler tools and special production machinery.

(682) Machine Tools

Machines for Milling, Broaching, Die Sinking, Grinding, Lapping. 49 pp. Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. This new catalog contains illustrations and condensed information on the complete line of products made by this manufacturer. A feature of this machine tool buying guide is said to be the fact that it contains an unusually large amount of engineering specifications packed into a small space.

(683) Riveting

Make the Hand Jobs Easy with Cherry Blind Rivets. 16 pp. Cherry Rivet Company, Dept. 72, Los Angeles, Cal. This new handbook is designed to aid men who are concerned with riveting operations on aircraft. It tells how to save time on difficult riveting jobs, gives complete information on the Cherry riveting process, and gives detailed instructions on the operation and care of Cherry rivet tools.

(684) Training

Carbide Training Course. 12 pp. Carboloy Company, Inc., Detroit. Said to result from a demand for sound training of carbide supervisors for industrial plants, this new booklet tells about this company's factory-operated training course. This course has been in operation for some three years and covers fundamentals involved in the design and application of carbide tools. It includes brazing, grinding, and tool handling practice.

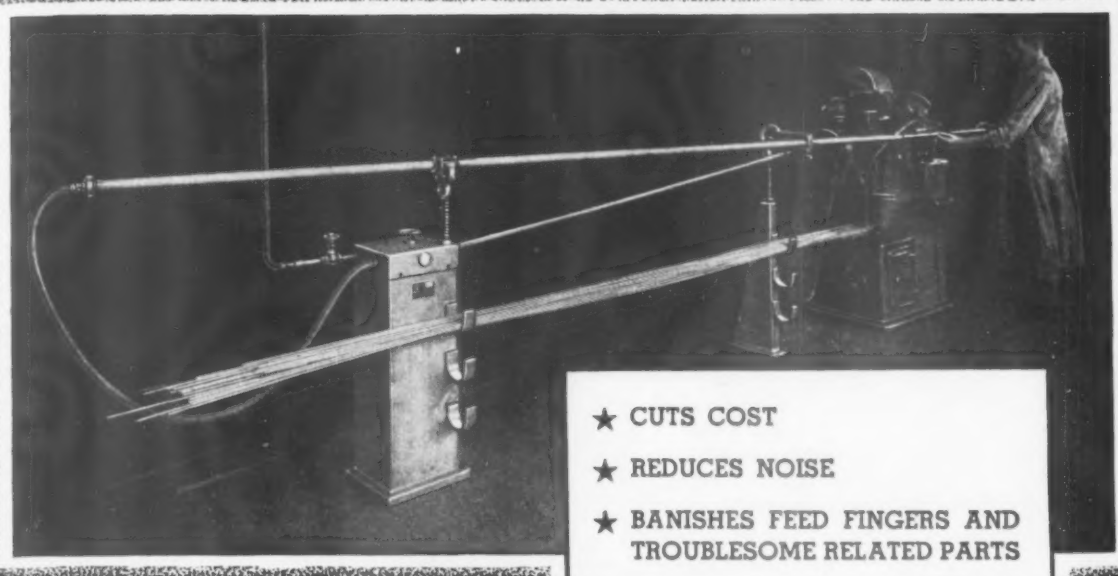
(685) Lathes

The Installation and Leveling of the Lathe. 20 pp. South Bend Lathe Works, South Bend, Indiana. This new bulletin covers the many points which must be taken into consideration when installing lathes. It is illustrated and

(Continued on page 186)

More Production...

Less Waste . . . Fewer Rejects



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describes such subjects as unpacking, illuminating, floor layout, supporting, and securing. Procedures for horizontal and transverse leveling are given.

(686) Motors

Ohio Motors Custom Built. 10 pp. The Ohio Electric Manufacturing Company of 5900 Maurice Avenue, Cleveland. This new bulletin describes and illustrates different types of motors made by this concern. It gives the range in voltage, speed, and horsepower available.

(687) Tool Shanks

Victory Tool Shanks. 12 pp. The Cooper-Bessemer Corporation, Mount Vernon, Ohio. The return postcard accompanying this new bulletin offers a tool shank for the asking. Fully illustrated, the bulletin describes and gives specifications of shanks cast to shape, shanks to tip with carbide, and shanks for users who tip their own cutting tools.

(688) Precision Instruments

American Products for Precision Craftsmen. 4 pp. The American Gauge Co., 125 Bayard Street, Dayton, Ohio. This new bulletin describes and illustrates the thread checkers, hole checkers, amplifying gages, bench centers, radius dressers, and lapping plates made by this company.

(689) Chromium Plating

The Last Thousandth of An Inch That Speeds Production. 16 pp. United Chromium Incorporated, 51 East 42nd Street, New York City. This bulletin tells how chromium plating saves and includes such subjects as salvaging parts and production tools, reducing corrosion on equipment, protecting precision of wearing parts, and increasing output of metal working tools. It tells how industrial chromium plating is made available. Booklet is illustrated.

(690) Steel

National Emergency Steels • Properties • Treatment • Application. 76 pp. Republic Steel Corporation, Cleveland. This new booklet shows that National Emergency Steels make the best and most effective use of the available supplies of alloys and alloy scrap. Object of the booklet is to make available to steel users all the information on these steels. Supplementary sheets will be sent to holders of this booklet as new developments come along.

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(691) Ball Bearings

Use Ahlberg Ground Bearings. 16 pp. Ahlberg Bearing Company, 3025 West 47th Street, Chicago. The cover illustration of this new booklet shows the types and styles of ball bearings that have been reground. The pages of this booklet show the steps taken by this company in the exchange, restoring, and replacing of worn ball bearings.

(692) Clamping Tools

Toggle Action Clamping Tools. 70 pp. Knu-Vise Incorporated, 2200 Eighth street, Detroit. This new catalog describes and illustrates the clamping tools manufactured by this concern. It includes toggle clamps with vertical or horizontal handles, adjustable base, and cam action. Also included are pliers, "C" clamps, vise grips, and knuckle action vises. A working drawing is shown with each model and a price list is included.

(693) Stitcher

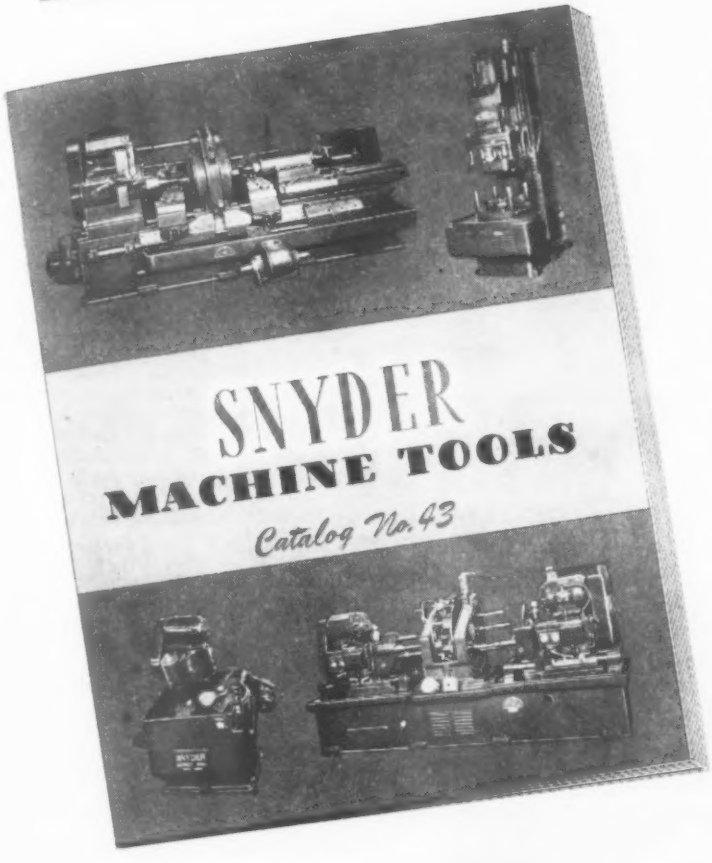
Morrison Wire Stitching Machines for Approved Faster Assembly of Aircraft. 6 pp. Seybold Division, Harris-Seybold-Potter Co., Dayton, Ohio. Typical applications of aircraft stitching on exhaust ducts, channel sections, trailing edges, and fire walls are shown in this new folder. The machine is illustrated and features are described. Examples are shown of stitching leather, textile, and plastic on aluminum and rubber on stainless steel.

(694) Milling Machine

The Lincoln Uni-Mill with Eklind-Lincoln High Speed Milling Attachment. 4 pp. Lincoln Machine Specialty

(Continued on page 188)

Now Ready . . . the new 1943 Catalog of SNYDER Machine Tools for better, faster production



Some thing more than just a catalog of machine tools is this new book which we have just published. In many ways it demonstrates how the principle of building special machines for the automobile industry has been applied by Snyder to designing machines, tools and fixtures for the great war industry. The book not only illustrates and explains some of these special machines, but it also shows how Snyder standard machines can be readily equipped to do the work of special machines. Consequently, we believe, the catalog is a good reference book for the engineering department that is striving for higher production and lower unit cost. Use the coupon below to request your copy.

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Please send me a copy of your Catalog No. 43

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Company, 549 West Washington Avenue, Chicago. This new bulletin illustrates and describes the Lincoln high speed milling machine base which is said to accommodate any make of high speed milling head. Chart shows specifications for table size and other parts of machine.

(695) Motors

Dumore Aircraft Motors. 28 pp. Dumore Company of Racine, Wisconsin. The complete line of Dumore standard and special aeromotors ranging from 1/50 to ¼ horsepower is presented in this new catalog. Actual size photographs, dimensional drawings, complete specifications, and ratings as well as the full descriptions of the motor's application and performance are included.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

(696) Pinion and Gear Cutting

Pinion and Gear Cutting Machines. 6 pp. Waltham Machine Works, Waltham, Mass. Describing and illustrating single-cut and multiple cut pinion machines, magazine-fed pinion machines, and gear cutting machines, this new folder includes examples of work done by these machines. Specifications are given.

(697) Diamond Wheels

Metal Bonded Diamond Wheels. 2 pp. Dia-Tool, Inc., Yonkers, N. Y. Such subjects as application, diamond concentration, depth of diamond penetration, metallic matrix, and recommendations are discussed in this new folder. The wheel is illustrated and is of the plain cup type. Complete specifications and prices are listed.

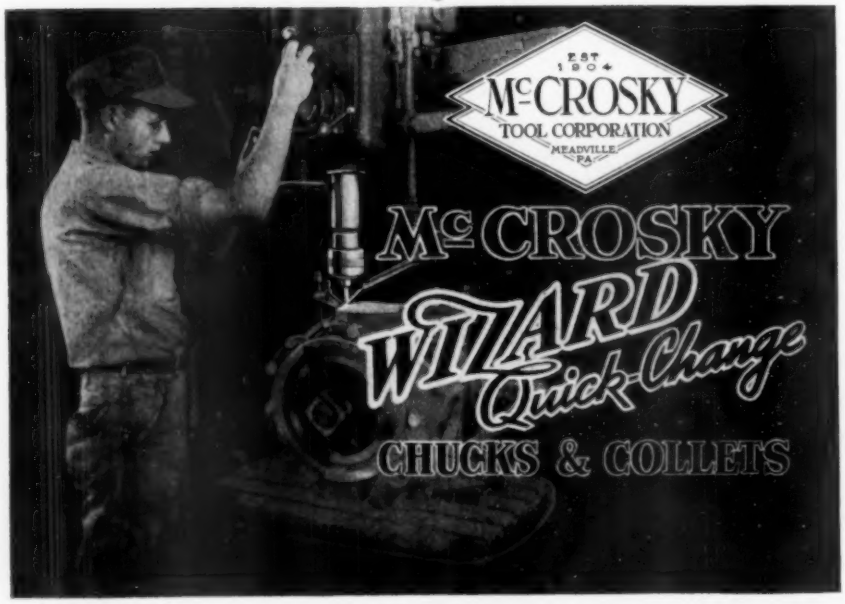
(698) V-Belts

Drive Production Higher with Veelos V-Belt. 8 pp. Manheim Manufacturing & Belting Company, Manheim, Pa. Illustrating the procedure to be used in installing the belt on the drive is just one of the points shown in this new catalog and instruction manual.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

McCROSKY's Wizard Quick-Change Chuck and Collet outfit makes tool changes on multi-operation drill press jobs into a continuous operation. The operator can change tools with one hand *without stopping the spindle.* Tools are held rigid and centered, permitting a Wizard outfit to be used *horizontally* as well as vertically. Four sizes of Wizard Chucks and Collets, and different types of collets for every kind of tool.

Full details in McCrosky Bulletin 16-D, and operating instructions in the McCrosky Wizard Quick-Change Chuck Manual.



NEW BOOKS

Tool Design by Cyril Donaldson and George LeCain. 465 pp. $3.75. Harper & Brothers, 49 East 33rd Street, New York City. Containing 536 illustrations, this new book is said to be a textbook for the preparation of the tool designer, tool engineer, tool maker, and draftsman. It is designed for use in factory training courses, technical schools, and engineering, science, and management war training courses.

The book is said to assume only machine shop and mechanical drawing preparation on the part of the student and provides a complete and systematic description of production tools. It contains material on manufacturing processes, drafting practice, materials, and welding—all said to be written especially for the tool engineer.

This textbook provides a supply of assignments for student work: questions, numerical problems, sketches, and practical design jobs.

Grinding Wheels and Their Uses by Johnson Heywood. 436 pp. $3.00. Penton Publishing Company, Cleveland. A second edition, this new book is completely indexed and is clothbound. Additional chapters incorporated in this edition deal with such subjects as disk, thread, and gear grinding. Other new chapters are on grinding dies and molds, lapping, honing, superfinishing, and the preparation of metallographic specimens.

Stress is laid on typical ingenious kinks for solving various problems. Suggestions are presented for designing parts to permit their being ground instead of machined by other methods when a better product can be made by grinding, or when production can be increased, or costs decreased.

All tabular matter dealing with wheel recommendations for various types of grinding have been grouped together in a separate appendix. This is followed by lapping compound recommendations and wheel breakage and safety tips. THE END.

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The tools of production will speed the winning of the war, if you keep them working. And you can! ***Salvage your rejected parts.*** Tools that take months to make can be reclaimed overnight with hard chrome plating. Stoppages in production due to wear and tear can be anticipated by hard chrome plating machine parts, dies, molds and other valuable tools. Call on Hartford Chrome now for prompt service that will expedite your war effort.

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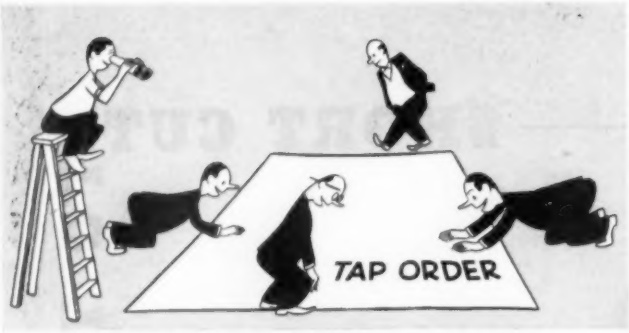

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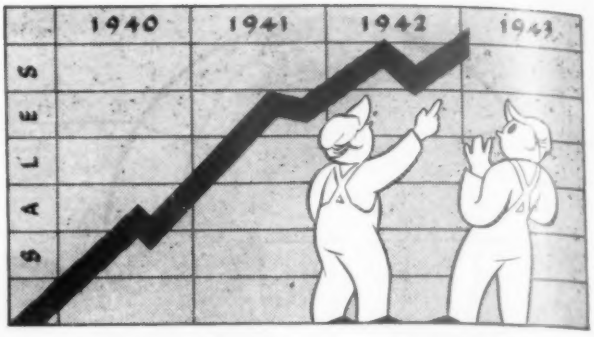

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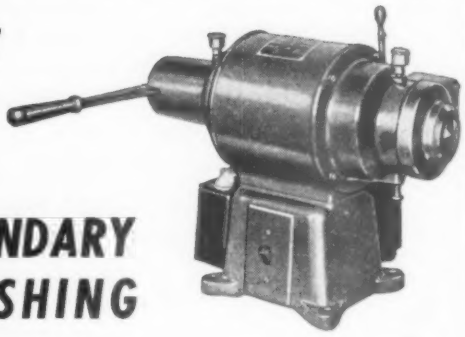

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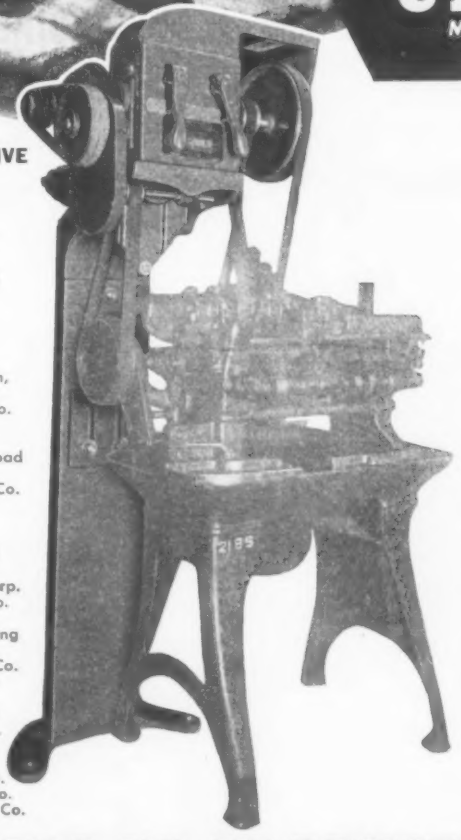

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Internal discharge thru center of intake eliminates outside piping.

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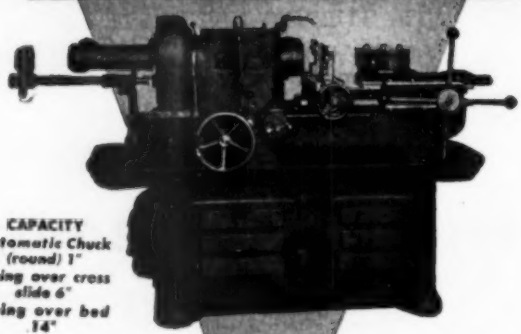
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



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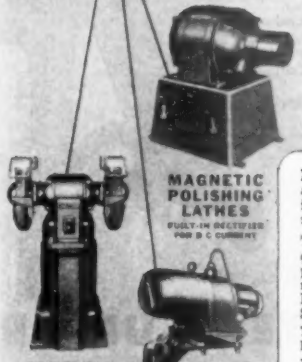
MOTORS ½ to 75 H.P.



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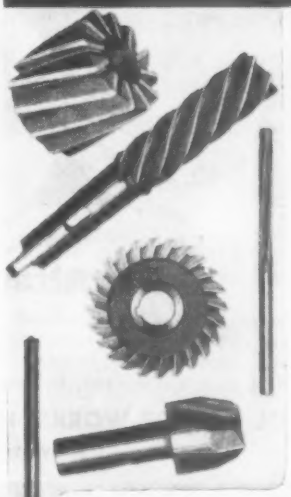

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T.M. REG. U.S. PAT. OFF.

CONGRATS to Detroit Chapter—and Messrs. Siegel and Diamond—on selection of officers for the coming year.

Geo. Whitehouse, ch'man, is a go-getter and popular, while 1st. and 2nd. Officers Jack Delaney and Ray Wilcox are live wires with beaucoup pep. Ray Farmer, sec'y., with his diversified interests, will doubtless function like the proverbial busy man, same being said for Otto Mueller, treas.

The quintette should make up the sulfanilimide to give No. 1, long ailing, a new hold on A. S. T. E. life. No criticism of predecessors implied; men have been busy and the secretaryship alone of Detroit Chapter has latterly been a bigger job than that of Nat'l. Sec'y a few years back.

But, with our large and growing membership (lately conspicuous by its absence) we need a renascence of the old time spontaneity and enthusiasm that made Detroit go out and make the world Tool Engineer conscious. "On with the A. S. T. E.!"

▲ ▲ ▲

Capt. Rickenbacker, alternately lauded a national idol and imputed a clay god, did the country a good turn by focusing public attention on industrial ills of which, in my opinion, but a small part may be laid to either labor or management.

By and large, both sides are doing their best, with all concerned getting tense and jittery from strain and overwork.

As for labor unrest (using the mild term) it's my belief that it can largely be attributed to a vacillating Labor Board that takes forever to make up its mind, and reverses its rulings when it does. If we're all going to be "in the Army now" let's have rules and work or fight by them. One thing or the other!

▲ ▲ ▲

A 48 hr. week or more is okay, provided there be time and opportunity for healthful recreation. But, what with gas rationing that barely gets one to work, and public transportation an ordeal as tiring as a day's hard work, there's just no place to go.

Now, soldiers get furloughs, so why shouldn't the industrial soldier merit his ozone?—i. e., within reasonable distances. Provide that, and the chances are strong that there'll be less absenteeism because of hangovers from recreating (?) at the corner pub.

Of course, the Drys are talking Prohibition again, (the damphools can't even learn from bitter experience!) as if war isn't bad enough without starting another super crime wave, let alone the graft and corruption that made the previous "noble experiment" an all time mockery of national moralfty.

Now, personally, I don't care if I never see another bottle of liquor, my occasional quips about Scotch benders having been mostly in fun.

So, it's not a personal issue. But, the principle of Prohibition (if any) is as wrong as Judas, implies a dictatorship utterly incompatible with the principles of democracy which we profess to champion.

However, I believe that it would be entirely right to ration liquor and beer in proportion to food and gasoline. In the meantime, educate the people to temperance, sans verbotens, and go on with winning the war. We'll have casualties enough from that without demoralizing the country with bootleg.

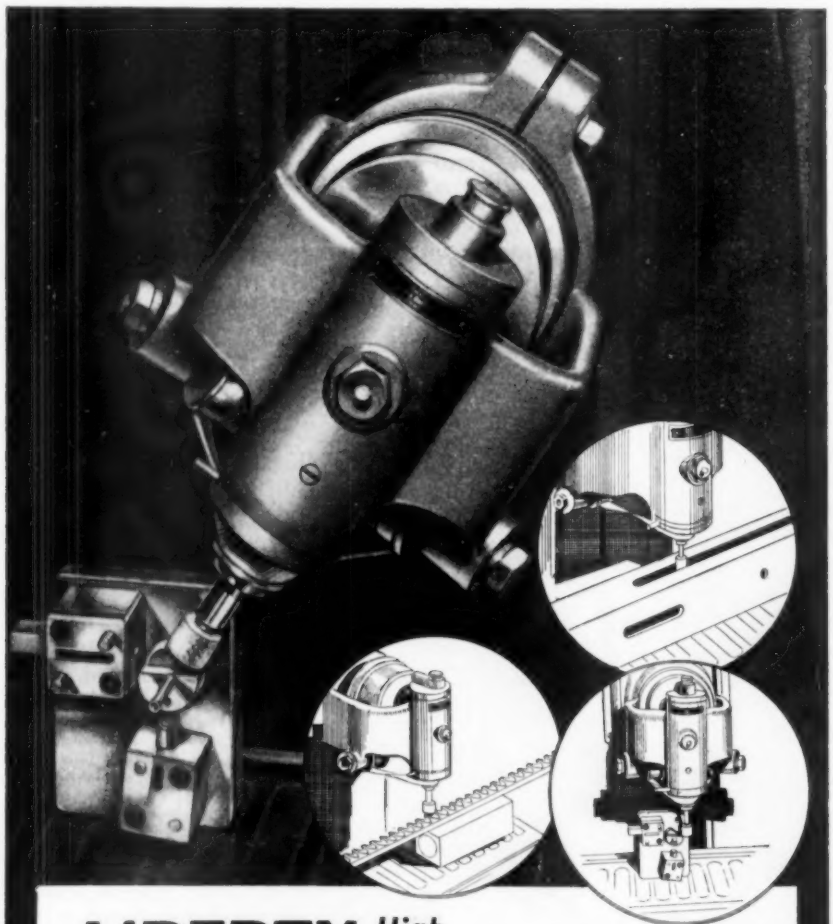
▲ ▲ ▲

Looks as if unhappy Finland is to call it a day, the Nazis (un)willing and the Reds reported agreeable to respecting territorial rights.

Well, whatever the sins of the Czarist regimes, my hunch is that the Soviet Republic is willing to live and let live, but not to be slapped down. If I'm wrong, one bridge at a time regardless; we can't give lip service to Allied Nations unity and stage a commie witch hunt at the same time. Anyway, (and I'm yet to be proven wrong) communism is to be feared only by decadent nations or decadent societies.

As for the influence of Russia on post-war Europe, a lot depends on who gets to Berlin first. If the Reds, let there be no suspicion of ulterior designs on the part of the western powers, because, the first unter der Linden

(Continued on page 196)



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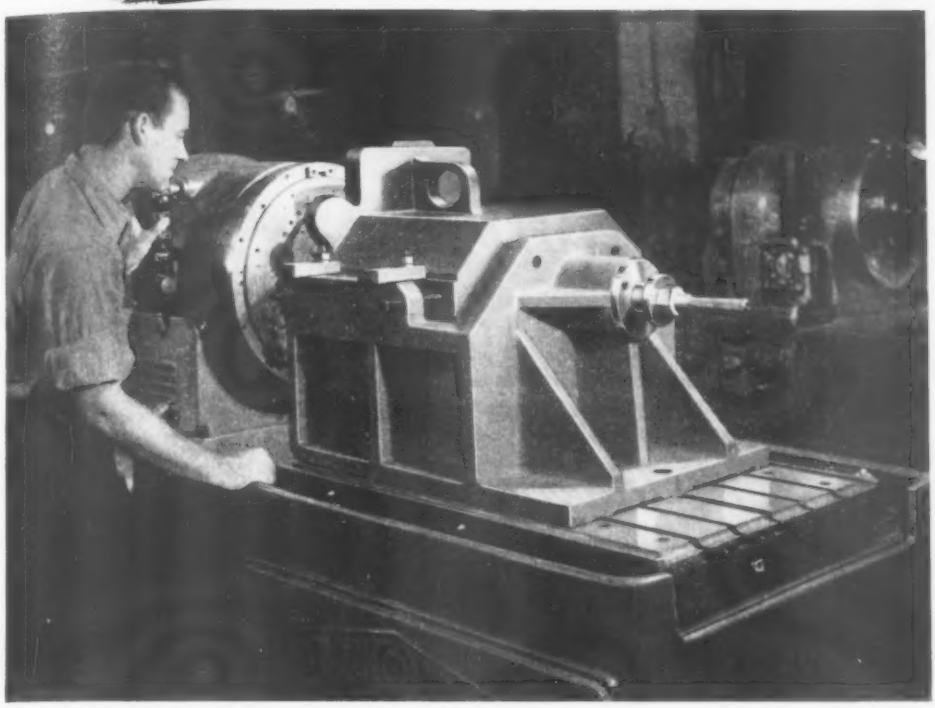

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will hold a royal flush at the peace conference. Let the obstructionists to Russian aid think that over—and worry!

▲ ▲ ▲

There's been a lot of prating about big nations gobbling up minorities, and maybe weak sisters may need a friendly power as a protection against the rapacious. Quien sabe?

But, in this land, reformers and demagogs, have been preaching the doctrine of social justice and the redistribution of wealth, all of which the masses of labor have swallowed without a thought to the axiom that force ever begets a counterforce.

Now, where are we heading? With accelerating pace, small business is forced to the wall—disintegrating!—while the national resources center in super-markets and industrial colossi. Perhaps I'm seeing the future through dark glasses, but surely future trends cast their shadows before them.

But then, it may all be a part of the scheme of abundance, but whether for the many or the few remains to be seen. Only, somehow, I wish that the Utopians had been content to reform through the slower but surer means of evolution instead of by industrial revolution.

Extremes ever beget extremes, yes, even super-wars. THE END.

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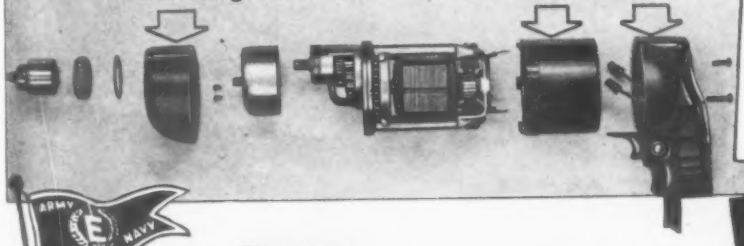

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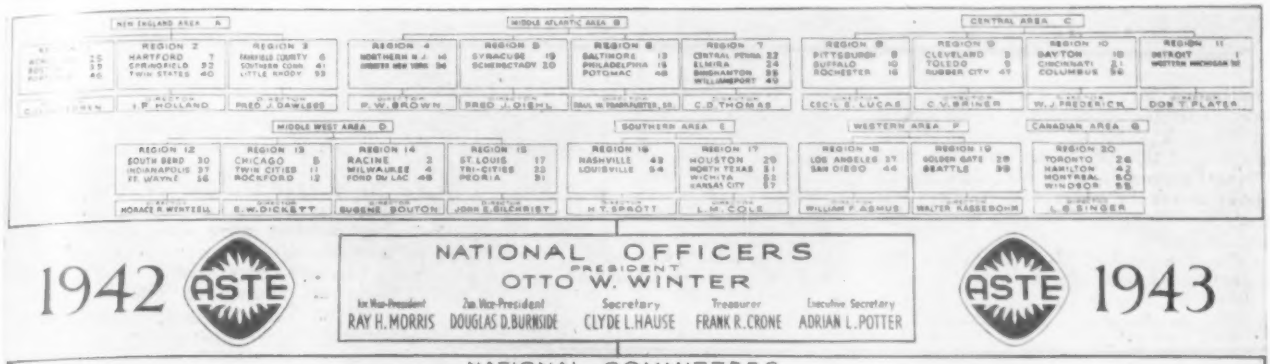

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A. S. T. E. DOINGS

Baltimore. Mr. A. H. d'Arcambal, vice-president and consulting metallurgist of Pratt & Whitney was the principal speaker at the March 3rd meeting held at the Engineer's Club. Mr. d'Arcambal spoke about the conservation of cutting tools and illustrated his talk with slides and samples.

Mr. d'Arcambal also conducted the induction of new officers at this meeting. New chapter officers are Charles W. Moyeer, chairman; J. Talbott, 1st vice-chairman; J. R. Stalloch, 2nd vice-chairman; H. C. Noll, secretary and J. Barnacle, treasurer.

Binghamton. Approximately fifty members and guests attended the March 3 meeting which was held at the Arlington Hotel. Vice-Chairman Mazar presided at this meeting and introduced Mr. Steve Urban, chairman of the Syracuse Chaper, who spoke a few words on behalf of incoming officers.

Mr. Mazar presented the charter to Mr. Becker and the books of office to other incoming officers. Several moving pictures were also shown at this meeting.

Chapter officers were elected at the February 3 meeting. The new officers include A. Becker, chairman; E. P. Burger, 1st-vice-president; D. Ahearn, 2nd vice-chairman; A. M. Pangburn, secretary and W. Harper, treasurer.

Boston. Over four hundred attended the "Fun-Nite" held at the Hotel Gardner on March 12th. Following the dinner, Regional Director John Lindegren installed the new chapter officers. An hour and a half show, under the direction of Danny White, followed the installation of officers.

Guests from other chapters included Charlie Page and Thom Barker from Portland, Maine, Wilbur Handy from the Twin State Chapter and Bob Lunney and Jim Law from the Hartford Chapter. Guests were also present from the Army and Navy.

Bridgeport (Fairfield County). Oscar W. Cooper was elected chairman of the chapter at the February 10th meeting held at the Stratfield Hotel. Other officers elected at this meeting included Mr. A. S. Curry, 1st vice-chairman; Mr. C. B. Christensen, 2nd vice-chairman; Mr. Ernest Reaney, secretary and Mr. Thomas Fish, treasurer.

Mr. Raymond L. French, district manager, War Production Board of Bridgeport, was the speaker. His subject was "The War Production Board Bridgeport District, Its Duties and Activities." Two films were shown at this meeting entitled "America Can Give It" and "Victory Is Our Business." These films were shown through courtesy of the General Motors Corporation.

Buffalo. Mr. H. L. Murch, optical engineer of the Jones & Lamson Co. was the speaker at the February 18th meeting held at the Lafayette Hotel. Mr. Murch spoke on "Measuring and Inspection by Projection."

Mr. J. E. Donald Hastie of the Carborundum Co. was the coffee speaker at this meeting. His subject was "Whys and Wherefores of Grinding."

Frank M. Wilson was elected chapter chairman at this meeting. Other officers elected included Thomas R. Goldsmith, 1st vice-chairman; Howard K. Rose, 2nd vice-chairman; Frank S. McCoy, secretary and Albert Kirchgessner, treasurer.

Speaker at the March 18 meeting was Stanley R. Cope, president of the Acme School of Die Design Engineering. Mr. Cope spoke on the subject "Drawing of Stainless Steel" and showed slides

(Continued on page 202)

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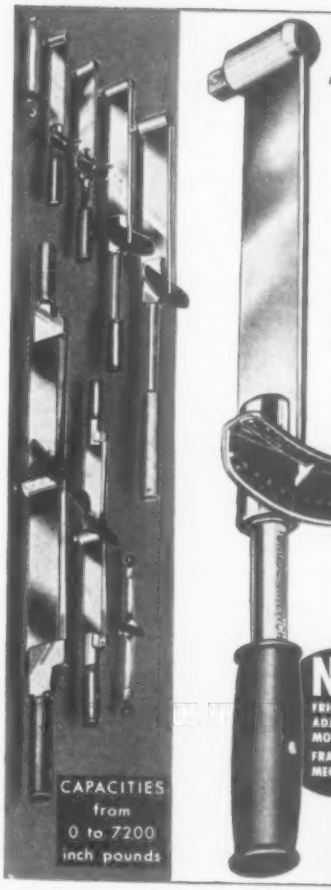

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of various dies designed to deep draw the steel. He also presented a movie in color of his trip to Brazil and Argentina.

Chicago. The March 1st meeting was the annual Smorgasbord and get-acquainted party held at Huyler's restaurant with more than two hundred and thirty-three members and guests in attendance.

Included in the entertainment was a mind-reading act given by Pingali and Pinella. There was also musical entertainment and a total of fourteen door prizes were raffled off to the lucky ticket holders.

Clare Bryan, Chicago Chapter member and the World's Champion Trick Bait Caster, gave an interesting demonstration of trick casting.

Columbus. Mr. E. H. Johnson, president of the Johnson Tool & Engineering Co., was the principal speaker at the March 9th meeting held in the Blue Room of the Hotel Fort Wayne. Mr. Johnson gave an illustrated talk on "Conservation of Materials and Special Purpose Machinery." Following his talk he showed a technicolor film produced by the Van Norman Machine Tool Co., entitled "Induction Hardening of Machine Parts."

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Mr. Judd and Mr. Peist of the Cincinnati office of the Ordnance Department showed a film entitled "[illegible] is Your Business."

Dallas. The February 6th meeting of the North Texas Chapter was held at the Hotel Jefferson. This was a special meeting and the program was introduced by Mr. Walter Thies.

Detroit. Mr. L. R. Twyman was the principal speaker at the March 11th meeting which was held at the Detroit-Leland Hotel. Mr. Twyman, manager of the Machine Products Division, Vickers, Inc., spoke on the subject of "The Application of Hydraulic Control to Machine Tools."

Elmira. John Lynch, the chapter's first chairman installed the 1943 officers at the March 1st meeting held in the Mark Twain Hotel. One hundred and forty members and guests attended this meeting and heard Ernest J. Abbott, technical director of the Physicists Research Company. Mr. Abbott spoke on "Production Control of Surface Roughness and the Profilometer."

Fond du Lac. "Grinding Wheels, Their Uses and Care and Cutter Sharpening" was the subject discussed and illustrated with a color sound movie at the March 12th meeting which was held at the Hotel Retlaw in Fond du Lac.

The speaker was Mr. V. H. Ericson of the Norton Company of Worcester, Mass. He was assisted by Mr. G. M. Ekberg of the Norton Milwaukee office.

It was announced at this meeting that this chapter will receive the membership trophy at the National Convention in Milwaukee.

Fort Wayne. The technical speaker, at the March 10th meeting held in the Chamber of Commerce was Mr. Hans Ernst, research director for the Cincinnati Milling Machine Co. Mr. Ernst spoke on "Machinability and Metal Cutting Research."

This was the first meeting of this chapter since it received its charter February 11th and 86 members and guests were present. The coffee speaker at this meeting was Major L. R. Kavanaugh, Public Relations Officer at Baer Field.

(Grand Rapids) Western Michigan. The February 8th meeting was held at the Morton Hotel in Grand Rapids and was attended by a group of twenty-one members. It was planned to hold the election of officers at this meeting, but due to the small group that attended, it was agreed to hold the election by mail.

The speaker of the evening was Mr. W. H. Wills of the Allegheny-Ludlum Steel Company of Pittsburgh. Mr. Wills presented both slides and movies on the subject of proper steels for tools.

Mr. J. H. Barry of the Bellows Company at Akron, Ohio also spoke at this meeting. Mr. Barry presented a short movie and talk on money saving ideas by the use of air-cylinders on various machine tools.

Hamilton. The March 12 meeting was the Annual Executive Night with many prominent plant executives from the

(Continued on page 204)

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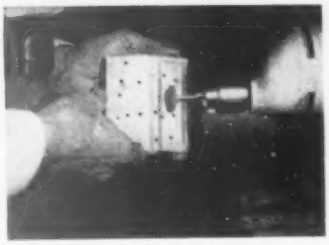

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surrounding district present. The guest speaker at the meeting was O. W. Winter, national president. Mr. Winter was introduced by Leonard G. Singer, regional director, and spoke about "Women In Industry."

As a souvenir of his visit to the Hamilton Chapter, President Winter was presented with a crested and engraved cigarette lighter. Mr. Fisher, chapter chairman, received a chairman's pin from Mr. Winter.

Hartford. More than one hundred members and guests attended the March 3rd meeting held at the Hartford City Club and heard Carl W. Bettcher, vice-president of Eastern Machine Screw Corporation of New Haven, Connecticut. Mr. Bettcher presented an analytical discussion of the subject "Production Screw Cutting." His talk included a review of thread sizes and systems, thread fits, machine conditions, machinability of stock, speeds and cutting fluids. He also described the evolution of the modern precision die head.

An educational motion picture was also shown at this meeting which described the latest developments in the tipping of cutting tools.

Houston. Election of chapter officers was held at the February 11th meeting with Chris Vogt receiving the office of chairman for 1943. Other officers elected at this meeting included Mr. [illegible] M. Krausse, 1st vice-chairman; Mr. [illegible] A. Welsh, 2nd vice-chairman; Mr. M. D. Carleton, secretary and Mr. H. R. Turner, treasurer.

Left: Cris Vogt new chairman of the Houston Chapter receives gavel from H. C. Collins, retiring chairman.

The speaker at this dinner and technical meeting was Mr. Louis Lingler of The Sheffield Gage Corporation. The subject was "Gaging in Modern Industry" and was illustrated with models as well as pictures.

Kansas City. The March 3rd meeting was held at the Union Station in Fred Harvey's Pine Room. Mr. **Evan Lewis,** engineering pilot, T.W.A., was the coffee speaker at this meeting and talked on "Engineering Pilots."

A sound film entitled "Heat Treating Hints" and furnished by Lindberg Engineering Company was shown during the technical part of the meeting. The technical discussion was conducted by Mr. V. E. Peterson, chairman, Industrial Relations Committee.

During the business session, new committee chairmen, elected by the Executive Committee, were introduced. They included H. R. Brown, Nominating Committee; George W. Hodes, Entertainment Committee; Edward L. Hessler, Meetings Committee; J. E.

(Continued on page 206)

Winning by a score of 180 points to 165 points, the Kansas City Chapter of the American Society of Tool Engineers was the victor over the St. Louis Chapter in a "Quiz of Two Cities Program" on Sunday evening, March 7. The program, heard over KMOX of St. Louis and WDAF of Kansas City, was commented upon by the producers as the best show they have ever put on. The Kansas City chapter was represented by Mr. and Mrs. W. W. Mason and Mr. and Mrs. Hutchison. The St. Louis chapter was represented by Mr. and Mrs. D. D. Burnside, Miss Betty Doogan and W. H. Scheer.

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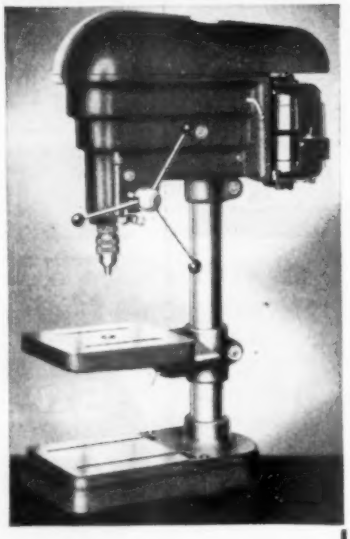

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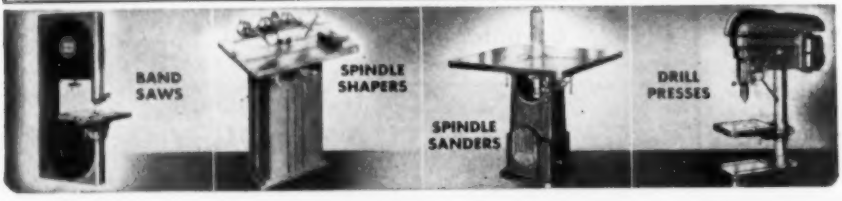

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Plastic GAGE HANDLES

Immediate Delivery!

- ★ Made of durable plastic material, they are lighter than any metals used for Gage Handles.
- ★ This light weight makes gages more sensitive to touch and reduces fatigue caused by long continuous use—particularly in the case of women inspectors. Insulates from bodily heat, helping maintain accuracy of gages.
- ★ Made to fit gages of standard sizes. Easily marked for identification with the same lettering used for metal handles.
- ★ The low cost represents a real saving. **Available in 6 standard sizes, in any quantity and without delay.**
- ★ **COLORS!!!** A new feature in Federal Gage Handles. Permits quick identification of types or sizes without measuring gages. Available in BLACK—RED—YELLOW—GREEN.

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402 North Leavitt Street, Chicago, Illinois

SCREW MACHINE CAMS
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B & S MACHINES

Cams cut to your layout shipped within 2 to 3 days.

Set of 3 No. 00 Cams including blanks, cutting, heat treating — $6.20 complete. Other sizes in proportion.

GEORGE L. DETTERBECK CO.
1871 CLYBOURN AVENUE
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SHELDON BBU-1242 WQ

Precision Lathe

- ★ This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a standard 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.
- ★ If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

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"Good Tool Steel" is good ammunition for high production.

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ARTHUR T. CLARAGE, PRESIDENT
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Bell, Jr., Editorial Committee and Burton O. Heinrich, Constitution & By-Laws Committee.

Louisville. A former French officer who helped plan the invasion of North Africa spoke at the March meeting held in the Kentucky Hotel.

The speaker, Robert M. Gerard, is at present an instructor in tactics at the Fort Knox Armored School.

Milwaukee. The March 11th meeting, held at the Red Arrow Club, was said to be one of the largest meetings in the chapter's history. Approximately two hundred and forty members and guests heard Mr. L. T. Weller, research engineer of the Electric Company. Mr. Weller gave a discussion in connection with high speed films, showing the action of cutting tools.

New chapter officers for 1943 were inducted at this meeting. Chairman Wernicke, new chapter chairman, was presented the chairman's gavel by retiring Chairman Iekel.

Moline. The Tri-Cities Chapter held its March meeting at the Blackhawk Hotel. The speaker at this meeting was Mr. E. A. Doogan, chief tool designer for the St. Louis Plant of the Curtiss-Wright Corporation. Mr. Doogan gave a talk on "Tooling for Airplane Manu[illegible]ring." He showed the methods [illegible] by his company in processing the t[illegible] for the building of the Curtiss airpl[illegible] and illustrated his talk with pictur[illegible]

The Glenn L. Martin Co. of [illegible]altimore presented a film entitled "[illegible]uild-ing A Bomber." Chairman Lu[illegible] announced that installation of offic[illegible] will be held at the April meeting.

Montreal. During a recent inspection trip through the Sorel Industries Plant at Sorel, Quebec, chapter members saw the vital part modern tool engineering plays in production of varied component parts of modern and field artillery units. Under the guidance of members of the Montreal Chapter employed at the Sorel Industries' Plant, eighty members inspected the range of modern tooling required in producing several types of naval guns and field artillery pieces. Mr. J. Edward Simard, vice-president of the company spoke to the visitors.

A paper was presented by Mr. Miller of Defense Industries Corporation on employee training. Mr. J. Cadorette of Sorel Industries gave a paper on the observations of an old time mechanic.

New Haven. Three lady tool engineers attended the dinner and meeting held March 4th at Hotel Garde. At the conclusion of the dinner which was attended by sixty-five members and guests, Chairman Dawless announced plans for ensuing meetings.

Guest speaker for this meeting was Carl Bettcher, vice-president, Eastern Machine Screw Corp., New Haven, Conn. Mr. Bettcher covered the fundamentals of thread cutting in his lecture entitled "Principles of Thread Cutting."

Three new members, James E. Kearsley, Raymond E. Atwell, and Thomas J. Reshenk, were announced at this meeting.

New York. The Gisholt Machine Company's film entitled "Turret Lathe Operation" was shown at the February 1st meeting held at the Hotel New Yorker.

At the business session which followed the technical part of the meeting, Mr. Russel, chairman of the Nominating Committee announced the slate of officers his committee had selected. Elections were scheduled for the next monthly meeting. One hundred members were present at this meeting.

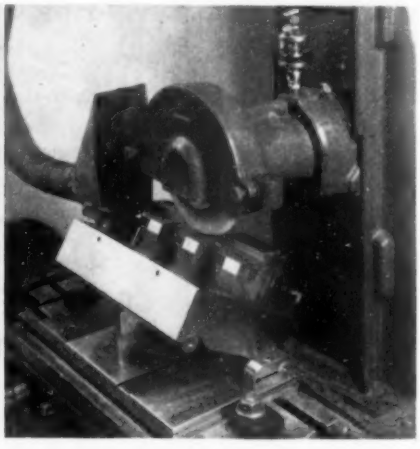
Philadelphia. Foster M. Crayton was selected as the new chapter chairman during election of officers at the February 18th meeting held in the Engineer's Club. Other officers elected included Adolph E. Burdick, 1st vice-chairman; W. B. Rapp, 2nd vice-chairman; W. Warren Cady, secretary and Howard W. Gross, treasurer.

Seventy-five members were present for dinner and one hundred members attended the meeting and heard Regional Director, P. W. Frankfurter give an outline of the National Meeting and Machine Tool Show to be held in Milwaukee.

To encourage members to make dinner reservations in advance, a free dinner for a member will be selected from the cards sent in for reservations.

(Continued on page 208)

Faster
MORE ACCURATE
GRINDING SET-UPS
with



The MAGNA-SINE

The grinding job shown above was set-up in just a few seconds using a Magna Sine. Three identical parts are being ground at one time . . . yet there is no danger that distortion from clamping or slipping on the table will turn the work into scrap.

The pieces are held securely by the turn of a switch. They are released with equal ease. Thus several similar parts can be ground in succession without disturbing the set-up.

The Magna-Sine employs the sine bar method, the only really accurate method of determining angles. It is precision built so that it is accurate to the limits of the gage blocks employed.

The Magna-Sine is manufactured for both single and compound angle work in two sizes. A non-magnetic sine plate built to the same close limits as the Magna Sine is also available for inspection. Write us today for complete information.

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318 MIDLAND AVENUE • DETROIT, MICHIGAN

METAL PARTS CLEANING
Low Cost — Efficient

for
CONTINUOUS
Large Scale
PRODUCTION

. . . the STURDY-BILT "Soaker-Hydro" CLEANER

Combines long "SOAKING-PROCESS" plus Hydro washing Action for large production. Parts are loaded onto trays, passed through the soaking tank — then are rinsed to remove oil film and clinging chips—then subjected to a power wash. They are removed dry and ready for use or for the next manufacturing operation. Simplicity is the keynote of construction as well as operation. Send for complete details.

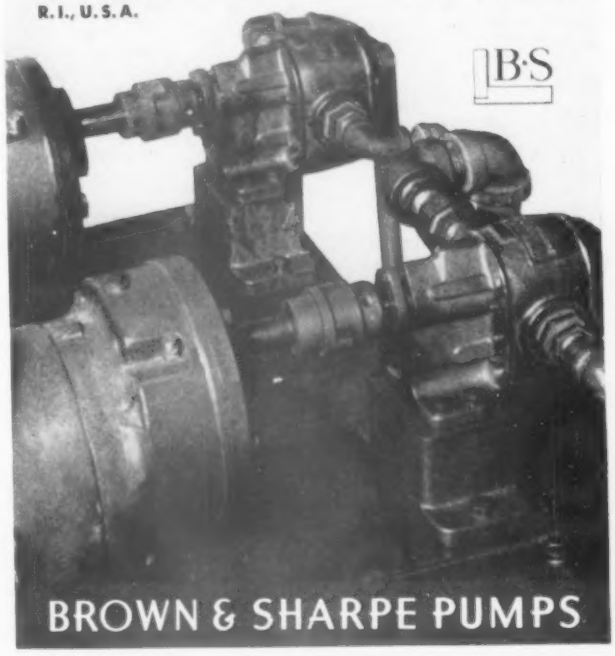
"SIMPLEX"
Metal Parts CLEANER

This small, compact, automatic and mechanically simple unit combines the two most positive methods of cleaning Metal Parts, Assemblies, Shells, Cartridges, Castings, Stampings, etc. A swishing action positively removes all grease, oil, dirt and metal chips that have been loosened during the "chemical action" of the "soak". Can be installed in different departments or in a series — one unit for cleaning, another for rinsing or rust prevention coating and others for special requirements. Send for "Simplex" bulletin for complete details.

STURDY-BILT EQUIPMENT CORP.
Department T-4 — WEST ALLIS, WISCONSIN

BROWN & SHARPE PUMP SETS
For Transfer — Lubrication — Coolant Supply

Pump Sets with motors, pumps and bed plates, direct or gear reduction drives, are advantageous for many industrial applications. Here two Sets are transferring oil from hardening room to cooling tank. Catalog listing Rotary Geared, Vane and Centrifugal Pumps forwarded upon request. Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.



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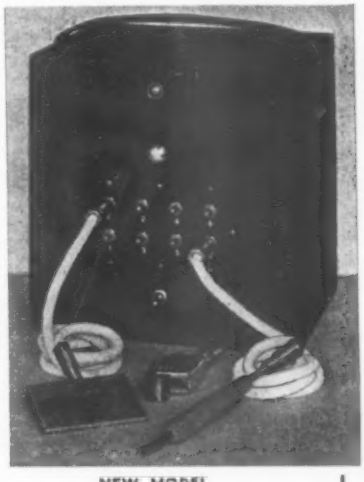
MORE THAN 3000 IN USE



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Buy the Original Electric Etcher

Three sizes to meet all requirements. Also a combined Etchograph and Demagnetizer.

WITH NEW ELKONITE TIP PENCIL

Mark *hardened parts,* tools, dies, gages and fixtures of any ferrous metals including the hardest alloys and carbides — quickly — plainly.

Write for circulars and prices.

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★ FOR INSPECTION GAGING . . .

BARTELT

PEDESTAL INDICATOR

★Here's a handy new gage that will be found useful in many ways around any production or jobbing shop. In the picture it is being used on a surface plate to gage height on an inspection operation. The pedestal permits an adjustable height range of from 0 to 3 inches and the dial reads in tenths. Write for circular showing a variety of other uses for the **BARTELT PEDESTAL INDICATOR.**

BARTELT ENGINEERING COMPANY
1214 PARTRIDGE AVE. - - BELOIT, WIS.

Pittsburgh. Sixty-six members and guests were present at the March 5th meeting which was held at the Hotel Mayfair. New chapter officers were installed at this meeting and during the program a past chairman's pin was presented to each of the five past chairmen.

The speaker at this meeting was Mr. Walter R. Buerckel who spoke to the audience on files. His talk was illustrated with both slides and a motion picture.

Providence. The Little Rhody Chapter met at the Sheraton Hotel February 23rd and elected chapter officers for the ensuing year.

Mr. Phillip S. Huntley was elected chapter chairman. Other officers elected at this meeting included Mr. Lloyd Sheeran, 1st vice-chairman; Mr. Ralph Cassady, 2nd vice-chairman; Mr. Albert W. Rogers, treasurer and Mr. Earl R. Phinney, secretary. Mr. Rogers and Mr. Phinney held the same offices in 1942 and were re-elected at this meeting for 1943.

It was also announced at this meeting that this chapter had elected its first woman tool engineer, Katherine Dunlap.

Racine. Sound movies illustrating the processes of machining and welding aluminum were shown at the February dinner meeting. The annual election of officers followed the technical session and William C. Davidson was re-elected chapter chairman.

New officers elected for this year include Robert Jones, 1st vice-chairman; Royal Beach, 2nd vice-chairman; Stanley R. Welling, secretary and Joseph Holzmann, treasurer.

Guests at this meeting included W. Z. Fidler, Midwestern area vice-chairman and a member of the National Membership Committee, and Eugene Bouton, regional director.

Rochester. The March 2nd meeting was held at the University of Rochester Lower Strong Auditorium in conjunction with the Rochester Chapter of the American Society for Metals. Preceding the meeting, approximately 80 members and guests of the two chapters had dinner at the Todd Union of the University and heard a coffee talk given by Mr. Harold Sanford, Editor of the Rochester Democrat & Chronicle.

The speaker at the technical session was Mr. L. C. Grant, metallurgical and chemical engineer of the Dow Chemical Co. at Midland, Michigan. Mr. Grant's subject was "Magnesium and Magnesium Alloys, Machining and Machinability." Mr. Grant gave some very interesting facts as to the growth of the magnesium industry. He described the four main processes now in use to obtain the metal.

A War Production Conference was sponsored by the W.P.B. through cooperation of the Radio, Mechanical, Civil, Electrical, and Tool Engineers of Rochester, New York on the evening of February 25th.

Three panels participated. One panel covered the "Training of Women for War Production", the second was on "Product Inspection" and the third was about "Getting the Most Out of Cutting Tools."

The Rochester chapter members who took part in these panels included Earl W. DeBisschop, Milton L. Roessel, Francis Spencer, Charles Franklin, William R. Gordon, Ralph Weddell and Chauncey G. Newton.

Rockford. The March 4th meeting featured a talk by Ralph E. Lilleberg, gage distribution manager for the Sheffield Corporation, who talked on "Dimensional Control and Gaging Policy."

Approximately 125 attended the dinner and meeting which was conducted by Ed Dickett. Mr. Dickett introduced the new chapter officers and took charge of the installation ceremony.

St. Louis. The March 4th meeting was held at the Elks Club and celebrated the fifth anniversary of the chapter. Installation of new chapter officers took place at this meeting with Douglas D. Burnside, national 2nd vice-president, in charge of the installation ceremony.

(Continued on page 210)

AT FOOD MACHINERY CORP.
SKILSAW TOOLS
RUSH AMPHIBIAN TANKS TO ACTION!
EVERY MAN
COUNTS FOR MORE
USING SKILSAW TOOLS!
Official OWI Photo by Palmer
Alligator Tanks they call 'em ... and they're wanted quick for rough, tough action on America's fighting fronts. That's why Food Machinery Corp. depends on SKILSAW TOOLS to speed production. Like the tanks they're building, SKILSAW TOOLS are fast, rugged, dependable ... they're action-tested front-line fighters in the Battle of Production!
You'll find these SKILSAW TOOLS preferred in war plants everywhere because they're lighter, more compact for easier handling ... more powerful for greater output per man on countless jobs. Ask your distributor to demonstrate SKILSAW TOOLS on your own work ... today! You'll see how greatly these better tools will increase your production!
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Atlanta • New Orleans • Dallas
Los Angeles • Oakland • Portland
Seattle • Toronto, Canada
½ IN. SKILDRILL—Light, compact, powerful for faster, better drilling, boring and reaming in wood, steel, compositions.
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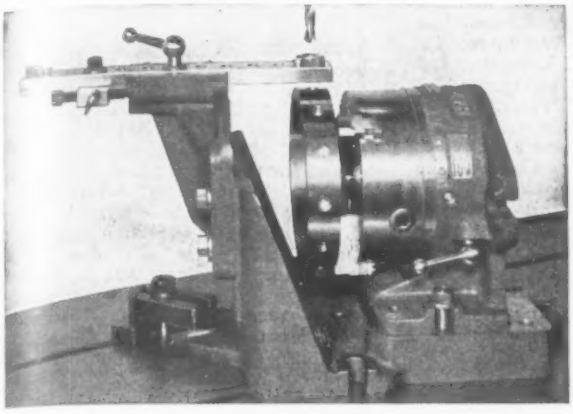
SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

"SUPER SPACER" DOES IT!



Above: "SUPER-SPACER" applied to a drilling operation. Here a supplemental base is used.

Other Applications—
GRINDING — MILLING —PLANING
JIG BORING — SLOTTING

WRITE FOR LITERATURE

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ROTOREX GRINDER FOR ALL TOOLS

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FOR HOLDING END MILLS AND OTHER TOOLS YOU CAN RELY ON UNIVERSAL COLLET CHUCKS

For gripping a tool "as strong as solid steel itself," you simply cannot beat a Universal collet chuck. The Universal chuck in the operating picture shown is holding a Putnam end mill while roughing cuts in high chrome steel. Universal chucks have ground threads, ample room for tool feed out and nut for Spanner wrench. Write for facts.

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Col. Merle H. Davis, Chief of the St. Louis Ordnance District, was the speaker at this meeting. Col. Davis spoke on "Measuring Ordnance Progress by Engineering Standards."

Granville Waters, chief engineer, Wagner Electric Company, gave a short talk on behalf of the executives of the St. Louis area. E. A. Doogan and D. D. Burnside were given past chairmen pins by the members. To commemorate the chapter's 5th anniversary the members purchased a $500.00 war bond.

San Francisco. The Golden Gate Chapter held its regular monthly meeting on February 18th at the City Club Hotel in Oakland. Results of the election of chapter officers at this meeting were as follows: Walter Kassebohm, chairman; Harold L. Wolpman, 1st vice-chairman; Louis A. Talamini, 2nd vice-chairman; Harold Burlingame, 3rd vice-chairman; Karl L. Bues, secretary and Fred N. Kruse, treasurer.

Mr. Charles Way, service engineer of the Warner & Swasey Co., was the speaker at the technical session. Mr. Way gave a talk on cutting tools and presented his company's sound motion picture on "Modern Turret Lathes and Their Operation."

Seventy-five members and guests attended the dinner and an additional fifty were present at the meeting and technical session.

Schenectady. The March meeting was held at the Watervliet Arsenal at Watervliet, New York, with 70 members and guests present for the dinner and 100 members and guests for the technical session which followed. The report for the balloting for officers was read by the secretary at this meeting.

W. A. Nelson was elected chairman; C. J. Sertl, 1st vice-chairman; F. R. Linehan, 2nd vice-chairman; C. E. Smart, 3rd vice-chairman; N. Y. Coxe, secretary and R. H. Wilke, treasurer.

The technical session featured a film "Heat Treating Hints — Second Edition." This film was shown by the Lindberg Engineering Co.

Mr. Wilson of the Allegheny-Ludlum Steel Corporation was a speaker at the technical session and gave a talk on tool steels and their heat treating. General A. G. Gillespie, Commanding Officer of the Arsenal, spoke very highly of the efforts of tool engineers in the present war program.

Seattle. The March 12 meeting was held at the Mayflower Hotel, with a dinner in honor of the newly elected officers for 1943. No business or technical session was conducted at this meeting and the 62 tool engineers present witnessed the installation of the new chapter officers.

Following the dinner, Mr. W. C. Fields acted as toastmaster for the evening's entertainment.

Springfield, Vermont (Twin States). Twin States Chapter held a dinner meeting, on March 12th in the Community Club at Springfield, Vermont. Mr. R. S. Gillette, the retiring chairman, thanked the committee leaders and the membership for their excellent cooperation during the year and introduced the new officers.

The speaker at the technical session was Mr. Everett S. Lee, director of the General Engineering Laboratory of the General Electric Company at Schenectady. Mr. Lee spoke on the subject of "Electrical Measurements as Applied to Industry." He discussed the development of measuring instruments from crude devices through modern developments employing photo-cells and balanced electronic circuits.

Syracuse. Steven Urban was re-elected chairman at the February 5th meeting held at the Hotel Syracuse. Other chapter officers elected at this meeting included Donald Babcock, 1st vice-chairman; Emil Floring, 2nd vice-chairman; Lester Collins, treasurer and Ray Coseo, secretary.

The one hundred members and guests attending the technical meeting heard Mr. C. J. Phillips, sales manager of the Insulation Division of the Corning Glass Works. Mr. Phillips' talk was on "Recent Developments in Glass."

This talk was followed by a sound movie entitled "Microtiming" shown through the courtesy of the Allegheny Ludlum Steel Corporation. Two films on Army training were also shown.

Toronto. The March meeting was held

(Continued on page 212)

Do you operate precision grinders that require sharp pointed diamonds? Then you require our sharp cornered Octahedrons which you see surrounding this ad.
They are carefully selected by our diamond experts for long wearing qualities. They are not cheap, but they are economical.
Don't delay trying them. Send your inquiry today.
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EVEREDE BORING BAR HOLDERS

The Everede Boring Bar Holders are adjustable to fit various size lathes. (Bushings are furnished with each boring bar for use in the Holders.) Everede Holders keep the boring bar in a horizontal position, regardless of any change in the size of the lathe, within limits.

The No. 1 Boring Bar Holder is used on precision bench lathes from 7" swing to and including 9".

The No. 2 Holder is used on engine lathes from 8" swing to and including 12", and the No. 3 Holder on engine lathes from 12" swing to and including 24".

The Holders are made of case-hardened alloy steel. A tool post block is attached to the engine lathe Holders by a chain as shown.

Send for descriptive folder.

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LESS OPERATIONS AND FAR BETTER WORK WITH A GATCO ROTARY PILOT BUSHING

Pilot bushing fits with a PUSH fit, therefore a perfect bore

ROUND-CHATTERLESS-SMOOTH

DUST-PROOF

AS A WATCH

GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

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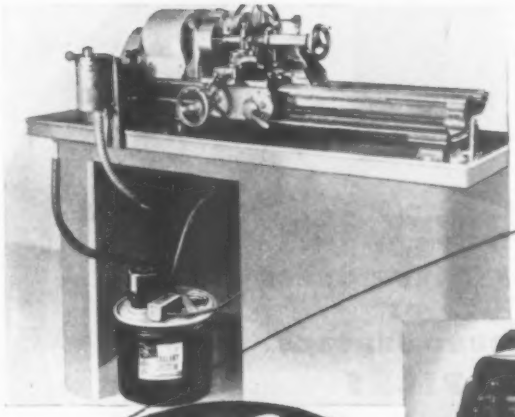
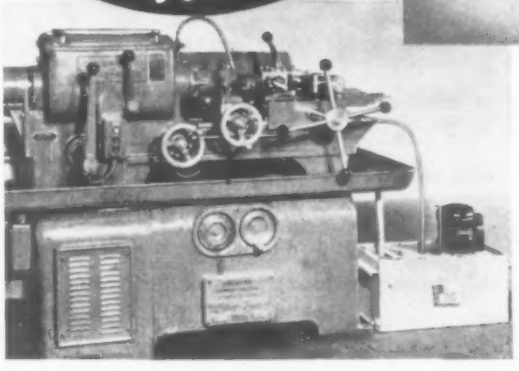


Gray-Mills *Portable* COOLANT SYSTEMS

HELP good LATHES do their best



Gray-Mills Self-contained Coolant Systems operate independently of the machine tool and thus assure complete freedom from unnecessary vibration and accuracy-destroying motor harmonics.

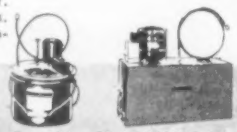
IMMEDIATE DELIVERY

SAVE *time and tools — increase production* by applying Gray-Mills Systems to your machine tools and equipment. The advantages of coolants have been given to lathes, like those above, by the simple and economical addition of coolant return pans and Gray-Mills Coolant Systems. Similarly equipped, hundreds of machines for milling, cutting, drilling, tapping, honing, belt grinding, sawing, etc. are producing more and better work.

Gray-Mills Systems are the answer to increased efficiency in small, large or special tools—or as standby and "cleanout" systems. They are available in pump capacities from 50 to 1,000-gals. per hour — controlled flow. Prices range from $39.50 to $132.50. Call your distributor or write for full details. Gray-Mills Co., 235 W. Ontario St., Chicago.

FLO-BAC COOLANTS

Five types of quality cutting fluids to cover practically every requirement. Available in 10 and 55 gal. containers. Immediate delivery from your distributor, or our plant.



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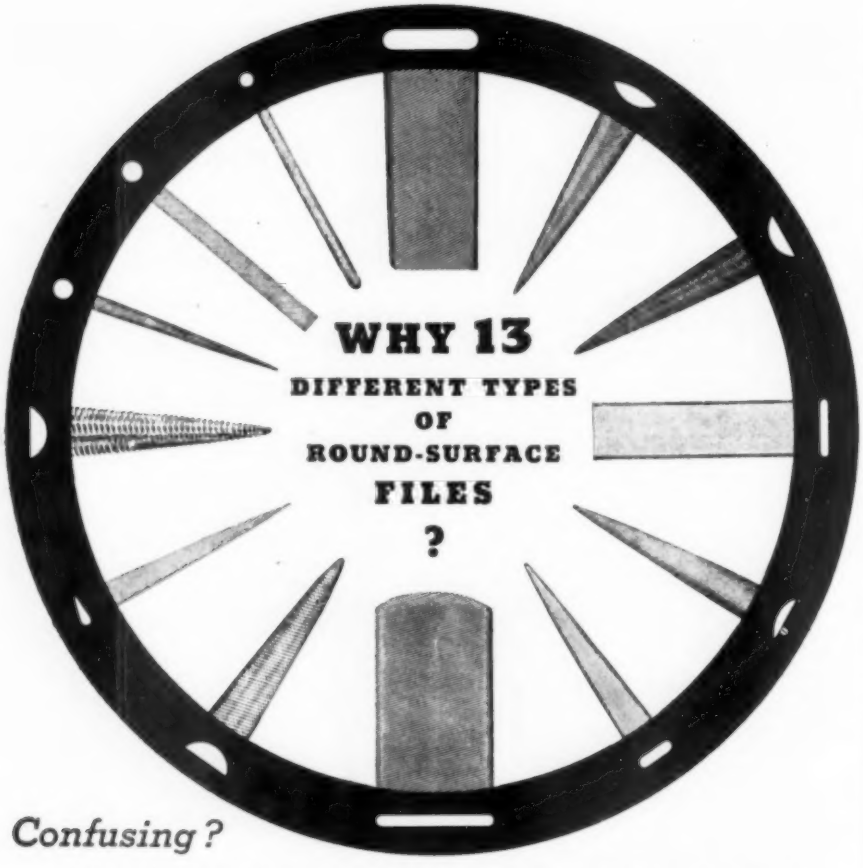
Complete Portable COOLANT SYSTEMS

Capacities 50 to 1000 G.P.H.
Pressures 8 to 150 lbs.



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SWISS PATTERN FILES

in the Engineers Club with about 80 members present. Speaker at the meeting was Eric Crawford, Publicity and Editorial Committee Chairman.

Mr. Crawford spoke about guns and their operation as he observed them during his visit to Canadian war plants.

A moving picture was also shown at the meeting through the cooperation of the Department of Munitions and Supply. Entitled "Great Guns," it described the manufacture and operation of 3.7 anti-aircraft, Bofors, Vickers pom-poms, and in addition showed guns in action in Russia.

Washington D. C. (Potomac). March 4th meeting was held at the Harrington Hotel with 78 present for a turkey dinner and 150 for the technical session. The meeting was in charge of Chairman Seifert who introduced the speaker of the evening, Mr. E. V. Flanders, manager, Thread Grinding Department, Thread Tool Division of the Jones & Lamson Co. Mr. Flanders spoke of the history of thread grinding and recent developments.

Movies entitled "Excursions in Science", "The Inside of Arc Welding" and "Beating Time" were shown through the courtesy of the General Electric Company.

At the business session the auditor's report was given, the delegate to the ASTE National meeting in Milwaukee was announced as Mr. Jay C. Reed, and plans were given in detail for the Ladies Night Meeting of April 1st.

Wichita. The members of the Wichita chapter met for dinner at the Hotel Broadview on the night of March 16th. Following the dinner, the group visited the factory of the Beach Aircraft Company where members were conducted through in small groups. All the manufacturing departments were visited and special attention was paid to tools and tooling.

Visitors at this meeting included Mr. L. M. Cole of the Houston Chapter who is a regional director and Mr. A. D. Furnans of the Carboloy Company.

Results of the chapter officer election held on February 18th were as follows: M. M. Ross, chairman; Donald H. Kirk, 1st vice-chairman; Harry Giwasky, 2nd vice-chairman; Wm. F. Grabendike, secretary and Roy W. Osburn, treasurer.

Williamsport. February 22nd meeting was held at the Elks Club with forty-three members and guests present. Chapter officers for 1943 were elected at this meeting with the following results: Harry S. Taylor, chairman; John H. Shafer, 1st vice-chairman; Warren C. Zweir, 2nd vice-chairman; William J. McCoy, secretary and Jesse L. Strasburg, treasurer.

Mr. P. Garlant, who was to have been speaker at the technical session, was unable to attend the meeting.

Windsor. The coffee talk at the February 8th meeting, held in the Prince Edward Hotel, was given by Jack Blowey, Mr. Blowey, director of the Ford Trade School told of the work being done by the school.

The nominating committee for the

(Continued on page 224)

FOR SPEEDY DRILLING OF SMALL HOLES

Drills more holes per minute.
Drills holes from 1/32" — in some metal to 3/8".
Used singly or in multiples.
Mounts on any angle.
Has in-built brake.
Quickly removable for other work.
Doesn't break small drills.

GOVRO-NELSON

AUTOMATIC DRILLING UNITS

PATENTED

PROVEN

PROTECTED

CENTRIFUGAL FEED

"HOLE"

ENGINEERING SERVICE

5901 FOURTH AVE. DETROIT, MICH.

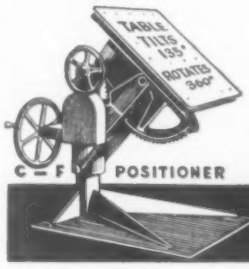
C-F POSITIONERS

Speed Production and Job Welding

Write for Bulletin WP 22.

C-F Positioners make welding a faster and more economical operation — save time, save man-hours. The welder himself turns and tilts and positions even the clumsiest and heaviest weldments with a push button control — without cranes, crane crews, hoist, jacks or "flopping" space. All sides can be welded down-hand — all welds can be made faster with heavier rods; made stronger, smoother and flawless.

C-F Positioners come in sizes and types for every welding need — range from small hand operated units for light job work to giant positioners that swing great weldments weighing 30,000 lbs. All have platforms that rotate the full 360° and tilt to 135° beyond horizontal. ***All are adjustable for height and are pedestal mounted to give greatest floor clearance.***



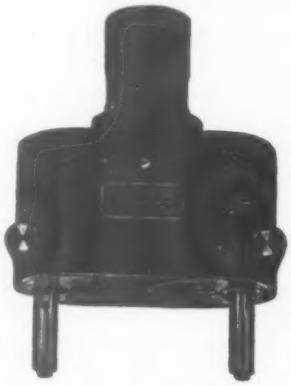
CULLEN-FRIESTEDT CO.,

1311B S. KILBOURN AVE. CHICAGO, ILLINOIS

U S

HEADS

STANDARD SINCE 1915



30 DIFFERENT STANDARD SIZE ADJUSTABLE DRILL HEADS, CAPACITIES UP TO 1½" DRILLS

SEND US YOUR B/PS

All Types of Fixed Center Heads

UNITED STATES DRILL HEAD CO.

Cincinnati, Ohio

Illustrated above is our modern daylight factory of 10,000 square feet devoted to the manufacture of precision gages.

OUR PRODUCT

Straight Side, Serration, Involute Male and Female Splined Gages, Plug, Ring, Snap, Flush Pin, Profile, Fixture, Length, Width, Thickness and Relation Gages. We have a complete Spline Engineering Service for your convenience. Gages with close tolerances are normalized and stabilized. All gages are inspected at 68° Fahrenheit. May we quote on your requirements.

AMCO GAGE COMPANY

19760 West Eight Mile Road Detroit, Michigan

with the
SCHERR COMPARITOL

Convenient, Fast, Accurate, Versatile

All uncertainties due to the human factor are eliminated in measuring and in checking with the SCHERR COMPARITOL. Any inspector will get the same reading on a given piece of work. Skilled operators are not required.

The COMPARITOL is ideal for precision inspection of plug gages, cylindrical ground work, screw machine parts and other work. The instrument provides visual readings on a scale graduated to .0001". Range is .004" with .002" plus and .002" minus. Two sizes available—Standard—Range 0 to 6" Price $195.00 Heavy Duty 0 to 8" Price $250.00

Investigate the COMPARITOL. Write for folder today.

GEORGE SCHERR CO., INC.
132 Lafayette Street New York, N. Y.

ADJUSTABLE SNAP GAGES for production inspection.

WILDER PROJECTOR for comparing by means of shadow image. $250.00

ULTRA CHEK — 36 gage blocks provide standard of measurements. $125.00

MAGNI RAY illuminated magnifier for inspection. $18.50

SPENCER MICROSCOPES for surface finish, imperfections. $142.50

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Rough Turned or Finished Complete

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Stainless & Copper Forgings
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AJAX STEEL & FORGE Co.

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Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . .
that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

We will see that your job is set up with the right LIVE CENTER—prompt deliveries on high priorities

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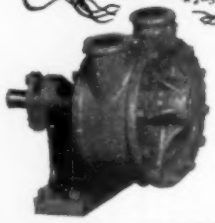
THIS PUMP OFFERS DEPENDABILITY AND SAVINGS



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GENERAL PURPOSE PUMPS

Tuthill Model C positive displacement, internal-gear rotary pumps are simple in design, compact and built to take it. Operate efficiently in either direction of rotation. Available in 8 sizes from 1 to 200 g.p.m. at pressures up to 100 p.s.i. on non-corrosive liquids. Direct drive, belt drive, V-belt units and stripped models.

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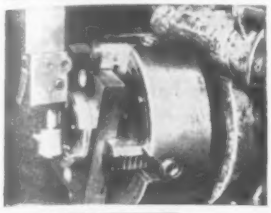
- SAVES ON FIRST COST
- SAVES POWER
- CUTS MAINTENANCE
- SAVES SPACE
- SAVES TIME
- SAVES MONEY

Tuthill PUMP COMPANY
939 East 95th Street • Chicago, Illinois

4 of the many ways SLOTMASTER can be used to save TOOLS & SETUPS

Left: Set-up for lapping deep impression Die.
Below: Set-up for cutting an internal gear.



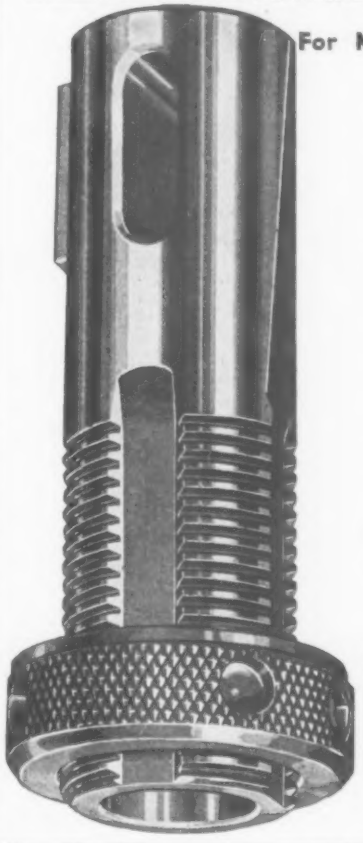
SLOTMASTER can be used on any round or flat-on-round overarm milling machine and will do precision work that normally requires a multi-thousand dollar machine. (All working parts are of tool steel heat treated and ground to close tolerances). It takes but little time to change over from one head to the other . . . the stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 S.P.M. The tool holder is of the clapper box type and can be turned in any position. SLOTMASTER comes complete with pulleys, motor, mounting bracket, etc. . . . Send for a 4 page catalog—give specifications of the milling machines you wish to equip.

Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE CO.
12601 Greiner
Detroit, Mich.

Below: Conventional set-up on a round over-arm milling machine; thumbnail shows set-up for cutting a spline.

GLENZER ADJUSTABLE ADAPTERS



For Multiple Spindles

STANDARD EQUIPMENT FOR ALL DRILLING REAMING AND TAPPING MACHINES.

ADOPTED AS STANDARD BY LEADING AUTOMOTIVE AND MACHINE TOOL MANUFACTURERS

Utility Tools

THE J. C. GLENZER COMPANY

6463-6477 Epworth Blvd.

DETROIT MICHIGAN

SIMPLIFIED INTERNAL GRINDING

with the MAJESTIC INTERNAL GRINDER

An exceptionally wide range of internal grinding jobs can be handled on the New Majestic Internal Grinder. Its simplicity of design and ease of operation are features of utmost importance in providing maximum grinding output at low cost.

SPECIFICATIONS

Length of table, 48". Swing over table, 10". Travel of cross slide, 2½". Precision dial graduated to .0001". Precision bearing work head. Speeds—100, 225, 350 r.p.m.

Write for complete details contained in New Bulletin

Majestic Tool & Mfg. Co.

2950 E. Woodbridge **Detroit, Mich.**

ARMSTRONG

LATHE AND MILLING MACHINE DOGS

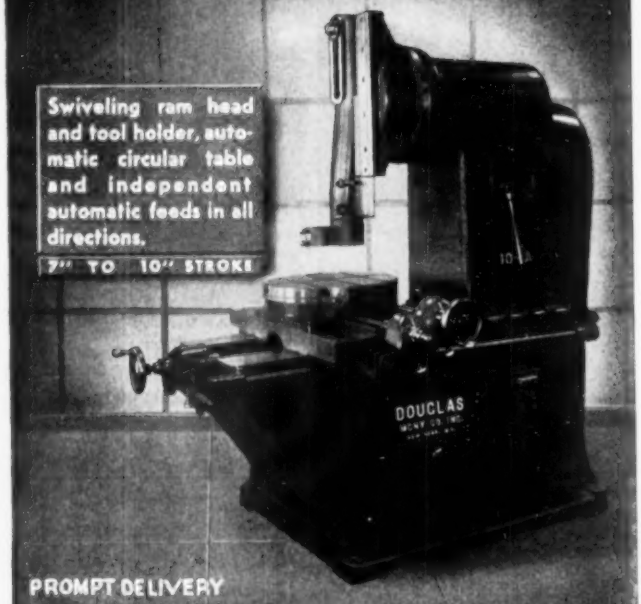
Because they are correctly designed and balanced and are drop forged from tough open hearth steel, heat treated to extreme stiffness . . . because they have alloy steel screws that are hardened at the point to prevent up-setting, and have oversize hubs that permit retapping . . . ARMSTRONG Drop Forged Lathe and Milling Machine Dogs ***have double life*** . . . are universally recognized as the finest obtainable.

11 types, all sizes. Write for Catalog.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
360 No. Francisco Ave., Chicago, U. S. A.
Eastern Sales: 199 Lafayette St., New York

DOUGLAS PRECISION SLOTTER


Swiveling ram head and tool holder, automatic circular table and independent automatic feeds in all directions.
7" TO 10" STROKE
DOUGLAS
PROMPT DELIVERY

DOUGLAS MACHINERY CO. INC.
150 BROADWAY NEW YORK, N. Y.

Many Times Greater Die Life by Using WILLEY'S DIES Made of WILLEY'S METAL

When you change from steel dies to WILLEY'S DIES, as illustrated, production goes up — costs go down. In the vital production of small arms ammunition and cartridge cases, Willey's Dies are proving their worth in many war production plants.
Catalog on request.

WILLEY'S CARBIDE TOOL CO.
1340 W. Vernor Highway. Detroit, Michigan

Expert Tapping with "Green" Help

Procunier Tapping Machines are designed to permit unskilled men and women workers to tap like experts. Actual production records show that "green" help get more accurate tapping, faster—with less tap breakage—when they use Procunier Machines. Here's why:

The extra-long spiral compensating springs, with wide range of hand screw adjustments, maintain pre-set tap feeding and reversing pressure INDEPENDENT OF OPERATOR! Other Procunier features that step up your tapping output are: 1. The improved Procunier tapping head with double-cone cork-face friction clutch: 2. Four speeds, ranging from 390 to 2050 RPM: 3. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads.

TAP ESTABLISHES IT OWN LEAD

The new Procunier Universal Tapping Machine is exclusively designed so that it actually allows the tap to establish its own lead. There is nothing more accurate than a precision ground thread tap as a guide for tapping—so maximum tapping efficiency is attained where an accurate tap is free to establish its own lead in cutting the thread.

SEND FOR CATALOG giving full details, description and prices on the full line of Procunier Universal Tapping Machines, complete line of Procunier Precision Tapping Heads to meet all needs and the new Tru-Grip Tap Holder.

PROCUNIER Safety Chuck Company
12 - 18 S. Clinton St., Chicago

Send me bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

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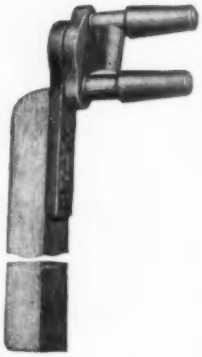
City..... State.....

Make Accidents Impossible



with the

"Safety First" Belt Stick

Style S1 for belts 1" to 3"
Style S2 for belts 3" to 4"
$2.00 each, $20.00 dozen

This belt stick end prevents accidents caused by operators throwing belts on and off moving pulleys with the ordinary belt stick with the single pin in the end. The "Safety First" is provided with three rollers, two of them being tapered. This stick cannot catch. At all times the tendency is for the belt to slide on to the pulley as the stick slides away. Stop unnecessary accidents in your plant.

Write for Catalog E-42

THE READY TOOL COMPANY
585 IRANISTAN AVE.
BRIDGEPORT CONN.

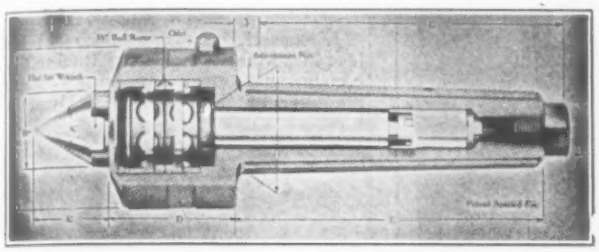
The Improved Nielsen Live Centers

LOAD CAPACITY—200 TO 40,000 LBS. AT 100 RPM.

HAVE ADJUSTMENT TO TAKE UP WEAR AND PRELOAD BEARINGS

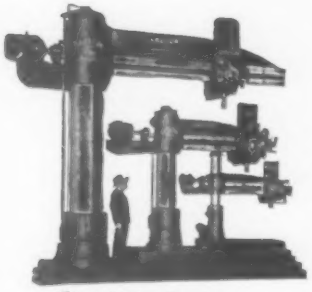
STANDARD MORSE TAPER No. 2 TO 6 IN STOCK

Write For Catalogue



NIELSEN, INCORPORATED

LAWTON, MICHIGAN



"Anti-friction Bearings Throughout"

CARLTON RADIAL DRILL FEATURES—

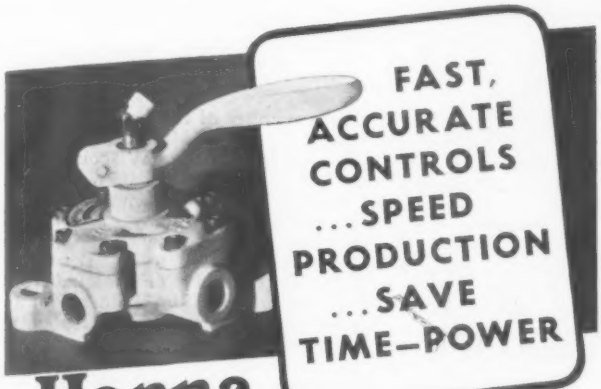
1—LOW HUNG DRIVE TO THE SPINDLE
2—ALL POWER DRIVEN PARTS RUNNING IN OIL
3—QUIET RUNNING AT ALL SPEEDS
4—CONCENTRATED AND CONVENIENT CONTROLS
5—CONSTRUCTED ON UNIT PRINCIPLE

THE

CARLTON

MACHINE TOOL COMPANY

CINCINNATI, OHIO, U.S.A.



FAST, ACCURATE CONTROLS ...SPEED PRODUCTION ...SAVE TIME—POWER

Hanna "Unitite" Valves

DEPENDABLE valves help assure maximum production efficiency—You won't find better Valves for the purpose than Hanna "Unitite" Controls because they offer:

- Permanent tightness
- Easy—quick maintenance
- Packless type construction

For air, oil or water, there are three styles to suit different mounting requirements.

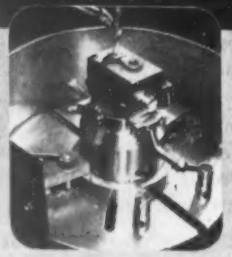
Write for complete details.

HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO, ILLINOIS
Air & Hydraulic RIVETERS • CYLINDERS • Air HOISTS

NEW WAYS OF *Hiking Production, Cutting Costs,* WITH ZAGAR FIXTURES

• The illustration above shows two 2" Zagar Holding Fixtures mounted on a Cincinnati production milling machine. One universal joint is cut while another is being loaded. The fixtures have standard tap holes to fasten special locating brackets. Production rate — 23 pieces per hour, No. 4140 steel, aircraft quality, about 1-3/8" diameter. The operator has time to burr all pieces completely.

Ask for a copy of our well illustrated Bulletin E-1



In this case production was doubled by using a 2" Zagar Indexing Fixture with a special drill jig for drilling and loading simultaneously.

ZAGAR TOOL, INC.
23880 Lakeland Blvd. Cleveland, Ohio

THE PASSING PARADE*

THE EVER-CHANGING SCENE IN MASS MANUFACTURING

*T.M. REG. U.S. PAT. OFF.

S. B. Taylor, works manager of the Reliance Electric & Engineering Company of Cleveland, Ohio, since 1931, was elected manufacturing vice-president at a recent meeting of the company's directors. Officers re-elected by the directors included **Mr. Charles L. Collens,** president; **H. Morley Hitchcock,** vice-president and treasurer; **A. M. MacCutcheon,** engineering vice-president; **James W. Corey,** sales vice-president; **C. V. Putnam,** secretary and **H. F. Walters,** assistant treasurer.

Walter H. Norton has just been appointed assistant general manager of the footwear division of the United States Rubber Company. At the time of his promotion Mr. Norton was production manager of the four footwear divisions of the company and had been with the concern 30 years.

Harry J. Hauck was elected a vice-president of Goss & deLeeuw Machine Company of New Britain, Connecticut on March 15th. Mr. Hauck is the retiring chairman of the Hartford Chapter of the American Society of Tool Engineers.

J. Russell Duncan, secretary of Peerless Machine Company of Racine, Wisconsin, has been appointed general manager of that firm. Mr. Duncan is also a member of the board of directors of the Ben-Hur Manufacturing Company of Milwaukee, Wisconsin.

J. RUSSELL DUNCAN
Now Peerless General Manager.

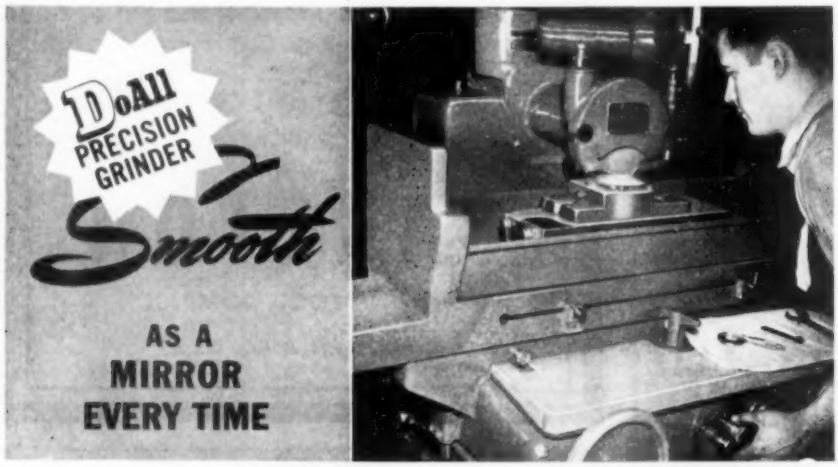
Robert W. Wolcott, president of the Lukens Steel Company of Coatesville, Pennsylvania was recently appointed as special assistant to WPB Steel Division Director H. G. Batcheller. Mr. Wolcott will handle problems of procurement, allocation, and use of iron and steel scrap.

Anthony J. Snyder, formerly engineer in the Physical Laboratory of Morse Twist Drill & Machine Company, has recently been made Works Manager of the concern's New Bedford plant. Mr. Snyder is a charter member of the Boston Chapter of the American Society of Tool Engineers.

Folke Richardz was recently appointed manager of engineering for the Westinghouse Electric & Manufacturing Company's Gearing Department at the Nuttall Works, in Pittsburgh, Pennsylvania. Mr. Richardz joined the Westinghouse staff in 1926 as a design engineer in the radio and photophone department.

Earl E. Smith of the Pratt & Whitney Aircraft Company at East Hartford, Connecticut was recently appointed assistant head of inspection and

(Continued on page 220)



● Especially designed and built with one purpose—to do the difficult task of super accurate grinding, so essential in our mass production program of today which calls for interchangeability of hundreds of vital parts.

The engineers worked for years to refine DoAll performance. Vibration is practically eliminated through rugged construction. Bearings are of larger area and hand scraped. Every part is so perfectly co-ordinated that you are assured of accuracy not only to size, but to flatness and parallelism.

GRINDING AT ITS BEST

For that final operation—a smooth, mirror-like finish—a finish that will pass every rigid inspection test—that will make a surface accurate to less than a ten thousandth of an inch, investigate the DoAll.

When the finish is so perfect that you can actually "wring" two flat surfaces together—well, that's super grinding—and that's what the DoAll has to offer. Adaptable to either wet or dry grinding.

EXTRA WEIGHT
OVER ONE TON
EXTRA BEARING AREA
1140 Sq. In. of Bearings HAND SCRAPED
DIRECT DRIVE
» » BALL BEARINGS IN SPINDLE ARE SUPER ACCURATE
MASSIVE COLUMN
POWER HEAD RESTS ON A PILLAR OF STRENGTH

Send for descriptive literature.

SAVAGE TOOL CO.

Dept. TE **Savage, Minn.**

DoAll Branches in 25 cities, each in charge of a trained sales engineer to give you quick service on Grinders, Gage Blocks, Contour Machines, Band Saws and Files. Consult your phone book.

Our compliments to a crew of men in our shop whose experience with us totals nearly 400 years.

We are proud of them and we are proud of the high reputation of our organization.

This long experience and high degree of skill is devoted 100% to war work.

NATIONAL TOOL SALVAGE COMPANY

6511 Epworth Blvd.

Detroit, Mich.

Gaging Accuracy MULTIPLIED BY 2

DUBLIFE REVERSIBLE PLUG GAGES

The Gage dependable ***for longest service*** is essential to speed precision production. DUBLIFE Gages double the life of gage accuracy, with reversible ends, both "Go" and "No Go". Turn either end when worn, and you have a new gage. Plugs locked by bronze split collet in one handle. Sizes: .030 to 1" UPPCO lapped, enduring finish.

United Precision Catalog shows full line with complete data. Also other gages of American Gage Design. Write

UNITED PRECISION PRODUCTS CO.

3517 West Belmont Ave., Chicago, Ill.

DANLY *Knurled*

All Die Makers' Supplies
Danly Commercial Sets
Danly Special Sets

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue, Chicago, Illinois
MILWAUKEE • LONG ISLAND CITY, N. Y.
DAYTON • DETROIT • ROCHESTER
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Los Angeles • San Francisco

DANLY PRECISION DIE SETS

PRECISION THREAD MILLER
FULL AUTOMATIC CONTROL

INTERNAL OR EXTERNAL RIGHT OR LEFT — UP TO 7 INCH DIAMETERS
COMPLETE MOTOR EQUIPMENT — FIXTURE TO SUIT

The James **COULTER** *Machine Co.*
BRIDGEPORT • CONNECTICUT • U. S. A.

quality control in the new Pratt & Whitney Shadow plant in East Longmeadow, Massachusetts. Mr. Smith was previously with the Studebaker Aviation Company at South Bend, Indiana and also with the Material Division, Air Corps U. S. Army at Wright Field, Dayton, Ohio.

M. Martellotti of the Cincinnati Milling Machine Company is chairman of a committee which is at work on a revision of the 1939 edition of the A. S. M. E. Manual on the Cutting of Metals. Other members of the committee include **O. W. Boston**, University of Michigan; **T. F. Githens**, Cleveland Twist Drill Company; **M. F. Judkins**, Firth-Sterling Steel Company; **M. E. Lange**, Warner & Swasey Company; **F. W. Lucht, Jr.**, Carboloy Company, Inc.; and **F. J. Oliver**, "The Iron Age."

Norman C. Einwechter has been appointed assistant to the vice-president of The Carpenter Steel Company it was recently announced. Mr. Einwechter, who has been a special representative for this concern, will have offices in New York and Philadelphia.

William J. Priestley, chief of the WPB Steel Division's Alloy Steel Branch since September 1942, has resigned that position to return to his post as vice-president in charge of research and development for the Electric Metallurgical Company of New York.

Robert A. Hurley has been elected vice-president and director of the Narragansett Machine Company of Pawtucket, Rhode Island. The former governor of Connecticut spoke at a dinner held in his honor at the Hope Club in Providence.

R. S. Neblett has been appointed assistant manager of General Electric's Federal and Marine division it was recently announced. Mr. Neblett has been with General Electric since 1923 and for the past three years has been assistant manager of the company's Turbine division.

Thomas C. Finnell was recently appointed manager of the Industrial Department in the Eastern District of the Westinghouse Electric and Manufacturing Company.

Herbert W. McKeague has been appointed purchasing agent for the Transformer Division of Westinghouse Electric and Manufacturing Company's Sharon Works.

Howard M. Givens, Jr., manager of tool steel sales for the Allegheny Ludlum Steel Corporation at Breckenridge, Pennsylvania, will make his headquarters at the corporation's Dunkirk, New York offices, according to a recent announcement.

Andrew H. Phelps, vice-president in charge of purchases and traffic for the Westinghouse Electric and Manufacturing Company, recently received the Westinghouse Order of Merit for exceptional service to the electrical industry and his company in wartime.

Bernard F. Nemerguth was recently appointed service manager of the Tocco electrical induction heating and hardening equipment division of The Ohio Crankshaft Company. Formerly chief test engineer, Mr. Nemerguth has been with the company for more than three years.

Clarence A. Gauger is in charge of the new factory branch of the H. M. Harper Company of Chicago which will be located in the I. N. Van Nuys Building in Los Angeles.

Hugh Acock has been named Texas district manager of the Wheelco Instruments Co., Chicago. His headquarters will be in Houston. **C. H. Garrison** has been named Kansas City representative of the same concern and **Russell George** has been added to the sales and service department of the company's Combustion Safeguard Division.

DIED

Max W. Babb, chairman of the board of the Allis-Chalmers Manufacturing Company, died March 13 in Milwaukee. Mr. Babb, who had been board chairman since January 1942 and the company's president for the ten years

(Continued on page 222)

Turning Hadfield Manganese Steel with Kennametal Tool Style 11

One of the greatest problems in the machining of metal has been the cutting of hard steels. In the past, output of highly accurate parts in this field has been hindered by the lack of an efficient tool composition. The discovery of an intermetallic compound, tungsten-titanium carbide, has provided the answer to the problem of machining steels of high tensile strength.

KENNAMETAL tools, made from this basic ingredient with binders of carburized tungsten and cobalt, and cemented in vacuum electric furnaces, have the requisite strength and hardness up to 550 Brinell.

If your problems involve machining steels of high tensile strength, use KENNAMETAL —the tool of faster, greater production.

KENNAMETAL THE All American CARBIDE

***INVENTED AND MANUFACTURED IN U. S. A.**

McKENNA METALS Co.

600 Lloyd Ave., Latrobe, Penn.

Foreign Sales: U.S. STEEL EXPORT CO., 30 Church St., New York
Exclusive of Canada and Great Britain

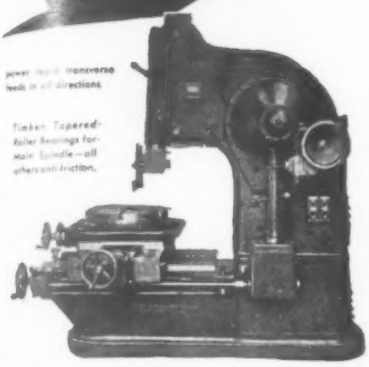
Trade Mark Reg. U. S. Pat. Off.

Accurate, High-Speed

MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE

SELF-CONTAINED MOTOR DRIVE



Built to highest accuracy standards the MOREY VERTICAL SHAPER is simple for tool-room manufacturing. Power feeds and power rapid transverse feeds in all directions are instantly available in all operating positions.

Ask for Circular 726

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

SAFETY WEDGE GRIP HOLDERS

- No Spalling!
- No Mushrooming!
- Positive Grip!
- Deeper Impressions!
- 50% to 100% More Service!

(Patented)

For marking airplane parts, rough and semi-finished shell forgings, gears, bars, and other machine parts. Can be furnished with any size and number of pieces. Patented Safety Snap provides quick change of Steel Type inserts.

Write for prices and complete information

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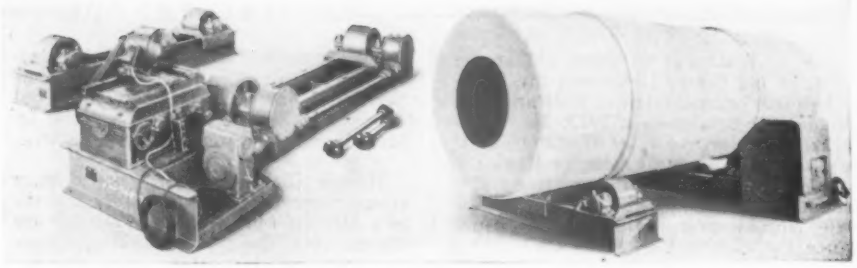

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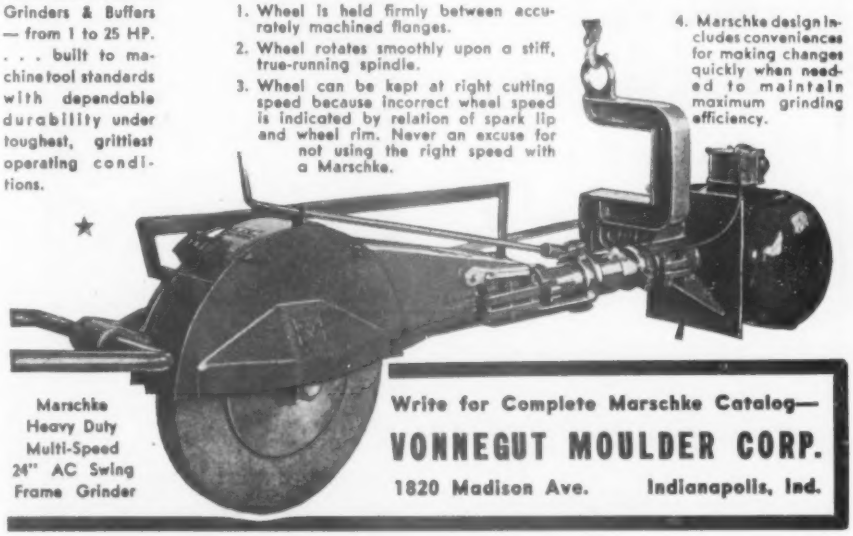

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prior to that, was 68 years old at the time of his death. He joined the Allis-Chalmers organization in 1904 and was made vice-president in 1913. Mr. Babb was a director of Cutler-Hammer, a director of the Federal Reserve Bank for the seventh district, and a trustee and a member of the executive committee of the Northwestern Mutual Life Insurance Co.

Jacob Andrew Menges, Pittsburgh, Pennsylvania, died February 22nd. He was employed by the Motch & Merryweather Machinery Company as a sales engineer for 22 years. Mr. Menges was born in Brownsville, Pennsylvania February 8, 1898. He attended the University of Pittsburgh and was a member of the American Society of Tool Engineers. Mr. Menges is survived by his widow, daughter and one sister.

Homer C. Bayliss, for twenty years co-manager of Motch & Merryweather's Detroit office, died in Detroit on March 14th. Born in Dennison, Texas on February 12th, 1885, Mr. Bayliss was a graduate of Marietta (Ohio) College and Ohio Wesleyan University. He is survived by his wife Edwina, a daughter, Mrs. Richard Gimon, Denver, Colo., and a brother, Wallace M., of Bridgeport, Connecticut. Mr. Bayliss was a member of the Detroit chapter of the American Society of Tool Engineers.

HOMER C. BAYLISS
Died in Detroit March 14.

Charles William Werst, chief inspector of The Baldwin Locomotive Works died recently in West Palm Beach, Florida. Mr. Werst was 75 years old at the time of his death and had been with The Baldwin Locomotive Works since 1898, with the exception of five years spent as general superintendent of the Lima Locomotive Works, Inc., at Lima, Ohio.

THE END.

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NEW LITERATURE

More New Literature on page 184

(699) Metal Saw

Johnson Metal Cut-Off Band Saw. 4 pp. Johnson Manufacturing Corporation, Albion, Michigan. This new bulletin describes and illustrates this saw in detail. Important features are shown and general specifications are listed. A list of 19 outstanding advantages is included.

(700) Spray Booths, Dust Collection

Aqua-Restor. 4 pp. Aqua-Restor Division, Mayer Manufacturing Corporation, 50 Division Place, Brooklyn, N. Y. Introducing a new line of paint spray booths and dust collection systems, this new bulletin illustrates and describes a number of booths for different industrial painting operations and a water-wash dust collector.

(701) Tool Salvage

Salvaging Tools. Eutectic Welding Alloys Company of 40 Worth Street, New York City. This instructive poster has been prepared for distribution to war plants and tells how to salvage tools. The data contained has been edited by this concern but the information and pictures were obtained from manufacturers using Castolin Eutectic low temperature welding alloys.

(702) Burners for Heat Treating

Selas Superheat Burners, High-Speed Concentrated Heat Sources Fueled with Gas and Air Only. 8 pp. The Selas Company, Erie Avenue and D Street, Philadelphia. This new bulletin includes 28 illustrations and introduces radical equipment for flame-hardening, flame-annealing, mechanized-brazing, preheating, and other localized open heat treatments. Also discussed are such subjects as applications, advantages, operating principles, and construction details.

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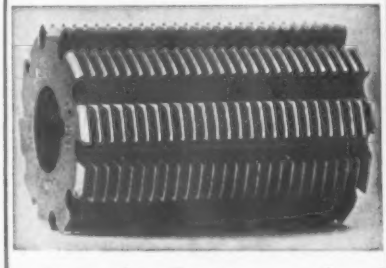

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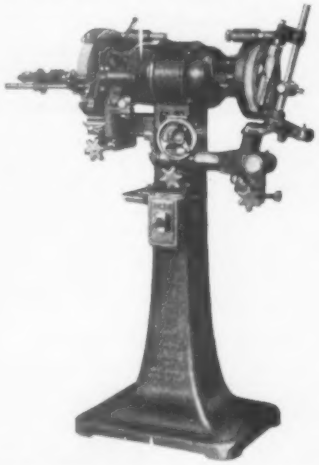

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APRIL MEETINGS

Cincinnati. April 13. Alms Hotel. The speaker of the evening will be Mr. Peter F. Rossman of Curtiss-Wright Corp.

— A. S. T. E. DOINGS —

(Continued from page 212)

election of chapter officers recommended that the present chapter officers be re-elected for 1943. Not only did the chapter approve of this recommendation, but it also unanimously resolved that the present treasurer, Geo. Staples, and the present secretary, D. M. Duncan, be elected for the next two years.

The regular technical session consisted of an illustrated talk by Mr. T. Buell, sales manager of the Sundstrand Machine Tool Company of Rockford, Illinois. Mr. Buell used lantern slides and a motion picture to illustrate his talk.

Worcester. The new chapter officers for 1943 were installed at this meeting. The installation ceremony was conducted by Mr. Lippard.

Mr. Peter F. Rossman, technical assistant of the Curtiss-Wright Corporation, Airplane Division, Buffalo, gave the talk at the technical session. Mr. Rossman spoke on the design of tools and dies for aircraft which he illustrated with moving pictures and slides. THE END.

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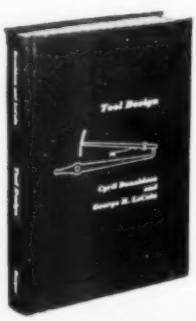

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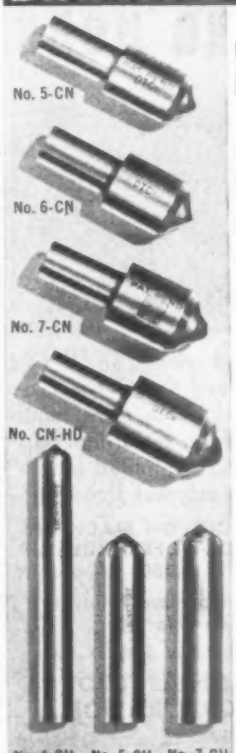

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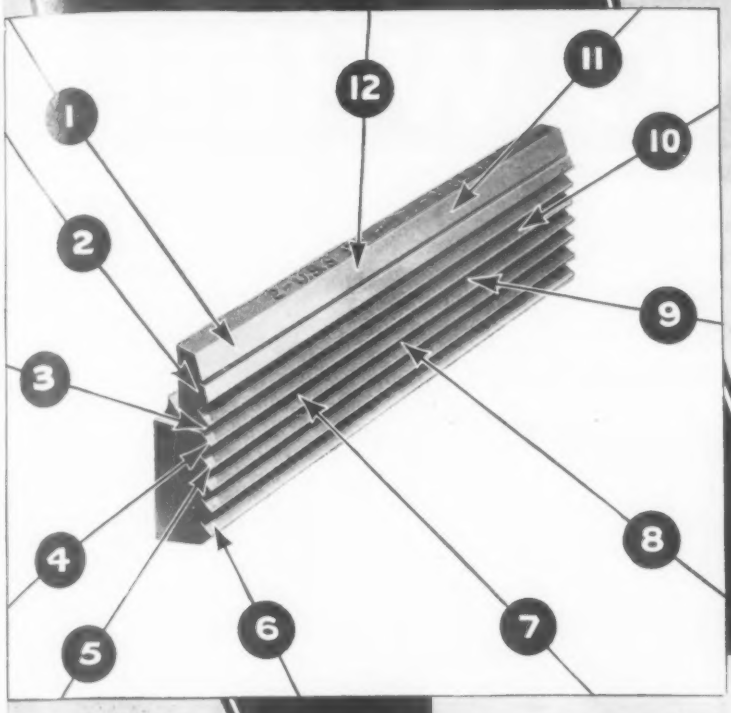
Acclaimed..
The Finest Thread Cutting Tool in Industry



The LANDIS CHASER

Used Exclusively in LANDIS Die Heads and Threading Machines

LANDIS

1-Permanent throat permits close to shoulder threading throughout life of chasers

2-Rake angle range covers all machinable materials

3-Free cutting condition permits maximum cutting speeds

4-Simple grinding operation renews entire cutting edge and leading feature

5-Line contact with work lessens friction and minimizes thread distortion

6-Leading feature insures thread of accurate lead

7-Lateral absorption of cutting strain reduces vibration and chaser breakage

8-Right and lefthand threading feature reduces chaser equipment

9-Standard chasers thread all diameters with proper chaser holders

10-Interchangeability of chasers lowers operating cost

11-Chaser length provides exceptionally long life and low tool cost

12-Permanent throat gives equal distribution of cut

The life of the Landis Chaser, due to its design which makes it possible to machine the thread form along the entire length of the chaser, is from ten to twenty times that of the hobbed type die.

The cutting edge is renewed completely at each regrinding thereby maintaining the original accuracy of the chaser. The throat is not altered by regrinding and therefore permits close-to-shoulder threading throughout the life of the chaser.

Landis Chasers are interchangeable—any one of a set may be replaced.

LANDIS MACHINE CO. Waynesboro, Pa.

MACKLIN GRINDING WHEELS

MADE in all sizes and shapes there is a Macklin Grinding Wheel for every type of grinding job that will show cost-saving results and *"Protect Your Production."* An experienced Macklin Field Engineer is available at all times for the asking—*no obligation.*

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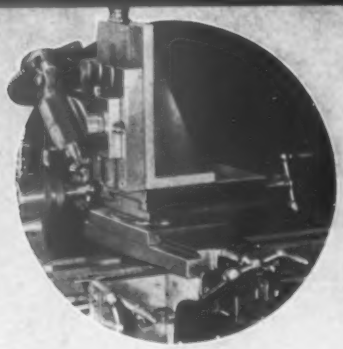
608 WITH VEE BELT DRIVE

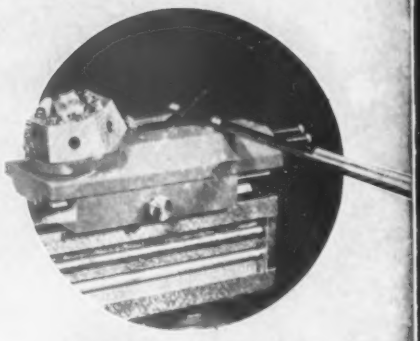
Tool-Making and Instrument Shops It Will Handle Great Variety of Jobs in Minimum Time

The Rivett No. 608 is a super-precision, back-geared screw-cutting bench lathe designed for fine manufacturing, repair and experimental work. In tool-making and instrument shops it will handle a great variety of parts within the closest precision limits.

Finely made attachments for drilling, spiral cutting, slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations enable the user of a fully equipped No. 608 to finish his work completely without recourse to other machines, and throughout his entire series of operations to utilize the inherent precision of the lathe itself.



Milling



Multiple Operations

SPECIFICATIONS

With Flat or Vee Belt Drive

Swing over bed dia.	8½"
Length of bed	40"
Distance between centers	18¼"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of top slide	5¼"
Slide rest, travel of cross slide	4½"
Feed range, through gear box	.0015" to .0220"
Thread range, through gear box	10 to 144
Tailstock spindle travel	3¼"
Spindle speeds:	
Flat belt drive—12 speeds	39 to 1295 r.p.m.
Vee belt drive—12 speeds	25 to 1500 r.p.m.
Weight of lathe, mounting and drive:	
Flat belt drive, net	900 lbs.
Vee belt drive, net	1050 lbs.

For Further Description Write for Bulletin 608

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

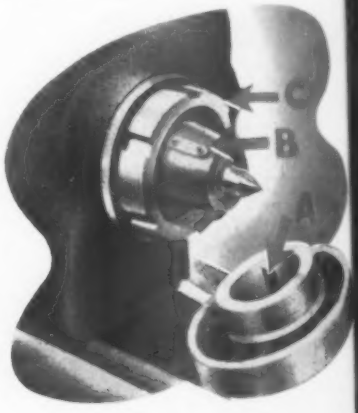
I'm tellin' y're

No. 7 in a series of tips on "Keepi 'em Tur
by Jimmy Slevins, over 40 years LeBlond

USING A CHUCK

Generally speaking, a chuck is used when the piece to machined is irregular in shape; large in diameter in proportion to its length; so long as to require its being pas through the spindle; or when it is to be bored or drilled the lathe axis.

On many lathes more than seven years old, there is a threa spindle which requires some special handling when you on or take off a chuck. On today's modern lathe this thr has been replaced with a standard taper spindle nose. H is the procedure for putting on both types.



TAPER SPINDLE NOSE

Simply place chuck on spindle nose with slot (A) fitted over key (B). This leaves both hands free to start and tighten collar (C). On or off the operation takes 12 to 15 seconds and is practically fool-proof.

OLD TYPE THREADED SPINDLE NOSE

Don't put chuck on with the lathe running. It is dangerous the operator and bad for the thread.

Hold chuck up to nose and revolve spindle by hand until engage then run chuck on by hand. If the chuck is too heavy for stead handling, place on a board across wings of carriage, using t board as a lever to raise chuck in alignment with threaded nos

Another good practice is to put a large washer made of blottin paper between spindle shoulder and chuck plate. This may see amateurish, but it helps to compensate for sticking threads whi is one of the disadvantages of this old type nose.

ARMY E NAVY

THE R. K. LeBLOND MACHINE TOOL

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Largest Manufacturer of a Complete Line of La